PB86-218401

Idaho Concentrated Animal Feeding Operations Water Quality Assessment

Jones and Stokes Associates, Inc., Bellevue, WA

19 Jul 85

U.S. Department of Commerce
National Technical Information Service
NTIS

50272-101

REPORT DOCUMENTATION PAGE	**1. REPORT NO.** EPA 910/9-85-132	**2.**	PB86-218401

4. Title and Subtitle

IDAHO CONCENTRATED ANIMAL FEEDING OPERATIONS WATER QUALITY ASSESSMENT

5. Report Date
July 19, 1985

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Organization Name and Address

Jones & Stokes, Inc.
1802 136th Place NE
Bellevue, WA 98005

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address

U.S. Environmental Protection Agency Region 10
1200 6th Avenue
Seattle, WA 98101

13. Type of Report & Period Covered

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

A large number of confined animal feeding operations (primarily feedlots and dairies) are currently operating in Idaho. Their numbers, locations, the type and number of their treatment facilities, and the extent to which they cause water quality degradation have not previously been well documented. The EPA is required to regulate discharges from concentrated animal feeding operations by the Clean Water Act, P.L. 95-217, and regulations developed pursuant to the Act. A number of the larger feedlots and dairies were previously regulated by the EPA under the National Pollutant Discharge Elimination System (NPDES) program in the mid and late 1970s. The majority of these permitted dischargers are still operational, although many have changed ownership, expanded, or reduced their operation. Some have ceased operation, and a number of others have been identified which were either previously unpermitted or which have recently become established. A series of EPA aerial surveys has provided a variety of site-specific information on confined animals operations along the Snake River drainages where feedlots and dairies are most concentrated. The information gathered by this study should be useful to regulatory personnel and planners at both the state and federal levels. An attempt has been made to include baseline information which will aid in management and enforcement at all regulatory levels.

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	**19. Security Class (This Report)**	**21. No. of Pages** 152
	20. Security Class (This Page)	**22. Price**

(See ANSI–Z39.18)

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

OPTIONAL FORM 272 (4–77)
(Formerly NTIS–35)
Department of Commerce

EPA 910/9-85-132

IDAHO
CONCENTRATED ANIMAL FEEDING OPERATIONS WATER QUALITY ASSESSMENT

Prepared for:

U. S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

With Technical Assistance From:

Jones & Stokes Associates, Inc.
1802 136th Place NE
Bellevue, Washington 98005

July 19, 1985

TABLE OF CONTENTS

Page

SUMMARY AND CONCLUSIONS i

CHAPTER 1 - INTRODUCTION 1

- Background and Purpose 1
- Report Organization 4

CHAPTER 2 - SOURCE ASSESSMENT 5

- Historical Overview 5
- A Statewide Perspective on Feedlots and Dairies 9
- Study Area and Methodology 12
- Source Quantification 13
  - Caldwell Area (Wieser to Glenn's Ferry) 14
  - Twin Falls Area (Glenn's Ferry to American Falls) 23
  - Blackfoot Area (American Falls to Sugar City) 34
  - Miscellaneous Operations 42
- Impact of Existing Sources 42
  - Potential Impacts from Confined Animal Feeding Operations 45
  - Stream Segment Characterization and Priority Segments 53
  - Groundwater Concerns 62
  - Priority Sources 66

CHAPTER 3 - INFLUENCE OF SOILS AND CLIMATE ON IMPOUNDMENT PERFORMANCE 71

- Overview of Study Area Soils 71
- Overview of Study Area Climate 76
- Climatic Influences on Runoff 77
- Relationship of Complaints to Precipitation 86

CHAPTER 4 - BEST MANAGEMENT PRACTICES AND DESIGN CRITERIA 93

- BMPs Effective in Water Pollution Abatement 93
  - Fencing 93
  - Runoff Diversion 93
  - Reducing Runoff Volumes 94
  - Reducing Land-Application Impacts 94
- Existing BMP Utilization and Effectiveness 95
- Existing System Design Criteria 98
- Recommended Design Criteria 104
  - Containment Requirements 104
- Operation and Maintenance Considerations 107
- Recommended Management Plan Contents 109

Page

CHAPTER 5 - NPDES GENERAL PERMIT APPROACHES 111

Existing General Permit Programs 111
- Federally-Administered General Permits 112
- State-Administered General Permits 115
- Conclusions Concerning Existing General Permits 117

Considerations in Issuing a General Permit for Idaho 118

Alternative Enforcement Approaches 121
- Alternative 1: Intensive Public Participation Program with Emphasis on Voluntary Compliance 121
- Alternative 2: Voluntary Emphasis with Financial and Technical Assistance 122
- Alternative 3: Combined Voluntary and Regulatory Emphasis 123
- Alternative 4: Source "Declassification" After BMP Implementation 124
- Alternative 5: Upgrade Health Department Requirements and Diversify Enforcement 125

REFERENCES 127

APPENDIX A - Precipitation Data

APPENDIX B - Characterization of Runoff from Idaho Feedlots and Dairies

LIST OF TABLES

Table		Page
2-1	Number of Feedlots, Dairies, and Animals Reported for the State of Idaho (1983)	10
2-2	Previously Permitted Operations in the Caldwell Area	15
2-3	Confined Animal Feeding Operations Identified by Aerial Survey in the Caldwell Area	18
2-4	Summary of Complaints Received by IDHW for Confined Animal Operations in the Caldwell Area (1973-1984)	21
2-5	Additional Dairies and Feedlots Potentially Requiring Permits in the Caldwell Area	22
2-6	Relationship Between Permits, Impoundments, and Complaints in the Caldwell Area	24
2-7	Previously Permitted Operations in the Twin Falls Area	26
2-8	Confined Animal Feeding Operations Identified by Aerial Survey in the Twin Falls Area	27
2-9	Summary of Complaints Received for Confined Animal Operations in the Twin Falls Area (1976-1984)	33
2-10	Additional Dairies and Feedlots Potentially Requiring Permits in the Twin Falls Area	35
2-11	Relationship Between Permits, Impoundments, and Complaints in the Twin Falls Area	36
2-12	Previously Permitted Operations in the Blackfoot Area	38
2-13	Confined Animal Feeding Operations Identified by Aerial Survey in the Blackfoot Area	40
2-14	Relationship Between Permits and Impoundments in the Blackfoot Area	43
2-15	Status of Miscellaneous Operations Referred to in IDHW Files	44

Table		Page
2-16	Waste Runoff From a Dairy Confinement Area	47
2-17	Waste Runoff From a Feedlot Confinement Area	48
2-18	Waste Runoff From a Dairy Cattle Yard and Milking Center	49
2-19	Average Concentrations of Selected Parameters Found in Direct Runoff from Feed Pens and Discharge Water from Collection Ponds	50
2-20	Pollutant Concentrations in Runoff from a Concrete Lot During a Single Storm Event	50
2-21	Reaction of a Stream to a Slug of Feedlot Runoff Passing a Sampling Point	52
2-22	Designated Uses of Water Segments Within the Caldwell, Twin Falls, and Blackfoot Study Areas	63
2-23	Number of Farms Identified by Survey as Correlated to Receiving Water Segment	65
3-1	Selected Temperature Data for Southern Idaho	78
3-2	Selected Precipitation Data for Southern Idaho	79
3-3	Climatological Data Comparisons	80
3-4	Cumulative 3- and 4-Month Precipitation at Boise, Idaho (1944-1983)	85
3-5	Estimated Evaporation Rates and Evaporation Opportunity Factors	87
3-6	Precipitation Adjusted for Evaporation Using Fall River Mills Rates and Evaporation Opportunity Factors	88
3-7	Cumulative Precipitation and Net Precipitation Adjusted for Evaporation for 3- and 4-Month Wet Seasons in Boise, Idaho	89
3-8	Monthly Distribution of Feedlot and Dairy Complaints Received in Boise and Twin Falls (January, 1979 - March, 1984)	91
3-9	Number of Complaints with Antecedant Rainfall Exceeding Average Rainfall	91
4-1	Comparison of Dairy Waste Management Plans	96

LIST OF FIGURES

Figure		Page
1-1	General Location of the Study Area	3
2-1	Location of Upper Snake Basin Stream Segments and Trend Monitoring Stations	54
2-2	Location of Southwest Idaho Basin Stream Segments and Trend Monitoring Stations	55
2-3	Location of Bear River Basin Stream Segments and Trend Monitoring Stations	56
2-4	Water Quality Index Values for Idaho's Principal Rivers (1983)	58
2-5	High Priority Water Quality Problem Areas	59
2-6	Pollution Sources and General Trends in Lake, River and Stream Segments	60
2-7	Location of the Snake Plain Aquifer	67
2-8	Groundwater Problem Areas	68
3-1	Status of Idaho Soil Surveys	72
3-2	Major Landform Provinces of Idaho	74
3-3	Isopluvials of 10-Year, 24-Hour Precipitation in Tenths of an Inch	81
3-4	Isopluvials of 25-Year, 24-Hour Precipitation in Tenths of an Inch	82
4-1	Generalized Diagram of a Single- and Twin-Cell Anaerobic Lagoon System	99
4-2	Generalized Diagram of an Aerobic Lagoon System	100
4-3	Generalized Solids Removal System	108

SUMMARY AND CONCLUSIONS

The USDA Statistical Reporting Service (SRS) estimates 2,500 dairies and 175 feedlots exist in Idaho. The great majority are located along the Snake River and its tributaries. EPA aerial surveys in this area have located and identified most of the larger operations and many of the smaller ones as well. Both the SRS and the aerial survey appear to greatly underestimate the total number of operations. In some areas, the aerial survey is estimated to have deleted or missed 50 to 90 percent of the facilities. Some dairy concentration areas were not within the survey flight path delineated by IDHW. A large number of operations on the photo were also unidentified for various reasons. Approximately 40-45% of those "missed" on the photos were screened out by the size criteria. The other 55-60% were overlooked because proximity of several small operations made them appear as one, or because animals were on summer range at the time of the survey (late April) and thus the operation did not appear to be a feedlot.

Previous permits were generally issued only to operations having a large number of animals. Most of the previously permitted operations were feedlots because dairies are generally much smaller and few contain over 200 animals. All but one of the 68 previously permitted operations lie along the Snake River and its tributaries; at least 2,000 smaller operations probably occur here as well.

Some regional differences in distribution of feedlots and dairies appear to exist. Distribution is primarily due to climatic factors and soil differences which affect crop growing. The Caldwell area contains most of the large feedlots as well as numerous small dairies and feedlots. The Pocatello-Blackfoot area has approximately equal numbers of dairies and feedlots. Nearly all are fairly small. Twin Falls contains by far the greatest number of operations, and nearly all are small dairies. Magic Valley, near Twin Falls, is the only location where the number of operations appears to be rapidly increasing, primarily due to migration from California. Other areas have few new (post-1974) sources.

The average surveyed dairy covers approximately 6 acres and contains between 50 and 200 animals. Feedlots tend to split into two groups: those having an average of 51-200 animals and those with >1,000 animals. They also tend to split into two size groups: those averaging <10 acres and those averaging around 50 acres. Although dairies are normally smaller than feedlots, they are often of greater concern as a group because of their large numbers and because they produce daily process waste as well as contaminated stormwater runoff. Dairies often have no impoundments of any kind; few of those that do are designed to accommodate runoff. In contrast, facilities for feedlots are constructed only for runoff containment.

A great number of both dairies and feedlots are located along streambanks and canals, and a large number allow animals direct access to the water. The number of dairies allowing access to water varies from 31 percent in Twin Falls to 48 and 50 percent in Blackfoot and Caldwell, respectively. Feedlots show similar values, with percentages ranging from 27 percent in Twin Falls to 40 and 71 percent in the Caldwell and Blackfoot areas respectively. While other operations impact waterways only when runoff or facility overflow occurs, operations that allow cattle access to water will produce a year-round impact.

Grade A dairies often cause fewer problems than grade B dairies because grade A cleanliness requirements are more stringent and require containment facilities (although facility standards are not defined). The majority (70 percent) of produced milk comes from grade B dairies, but there is a current trend toward upgrading dairy status. This should produce some water quality benefits as more farms construct containment facilities to attain grade A status.

Nearly all river segments in the study area are classified as having marginal quality (i.e., having moderate or intermittent pollution). In all major drainage basins, nonpoint source agricultural activity is considered the main factor in water quality degradation, although for a number of reasons, direct correlation between source and impact is difficult if not impossible. An evaluation of aerial survey data supports this conclusion; the stream segments having the highest numbers of dairy and feedlot operations also tend to have the poorest water quality.

There appears to be a downward trend in water quality over the last few years. Stream segments considered to be high priority segments in terms of dairy and feedlot impact within the study area include Rock Creek, the lower portions of the Boise and Payette Rivers, Big Wood and Little Wood Rivers, Mink and Worm Creeks, Bear and Cub Rivers, and Deep and Cedar Draw Creeks.

Present and projected stream uses for stream segments in the project area range from less sensitive uses, such as agricultural supply and secondary contact recreation, to more sensitive uses, such as salmon spawning and domestic supply. Except for water supply, nearly all streams are protected for biota and contact recreation as well as agricultural use.

In attempting to control surfacewater pollution, the possibility of groundwater pollution should not be overlooked. The area along much of the Snake River is under consideration as a Sole Source Aquifer. Elevated nitrate levels already exist in much of this area, and contamination from surface activities is a possibility in many areas where lava or porous substrate occur. Because of the extensive use of this aquifer, activities above the aquifer, particularly from Hagerman to Idaho Falls, should be carefully regulated. This area contains many of the most heavily concentrated dairy areas in the state.

The previous permit program had minimal impact on impoundment construction. The percentage of previously permitted operations having impoundments is not greatly different from the percentage of previously unpermitted facilities which have them. Only 45 percent of the permitted operations and only 28 percent of the total operations surveyed had impoundments of any kind. Approximately 72, 84, and 76 percent of feedlots have no impoundments in the Caldwell, Twin Falls, and Blackfoot regions, respectively. The percentage of dairies without impoundments shows more regional divergence, being 50, 64, and 91 percent, respectively. The great majority of dairy impoundments are designed only for process waste, not for runoff. Few impoundments already constructed should be considered adequate to protect water quality. Little effort appears to have been made to contain runoff at all, much less meet EPA effluent limitations. Whether operations having impoundments meet EPA effluent limitations cannot be determined from the files or survey data; individual site inspections would be necessary to determine actual depth (and therefore volume) of the impoundments. Discussions with local and state enforcement personnel, however, indicate only a very small percentage of facilities that do have impoundments adequately address runoff.

There are few enforcement tools, and a number of factors contribute to enforcement problems. There are no well-defined state mechanisms for enforcing proper waste facility design, no requirements for plan review and approval, and no animal waste regulations. The canal companies, local health departments, and IDHW all have a limited degree of enforcement capability, but many physical and political factors hamper enforcement effectiveness.

Ideally, each farm should have a management plan that contains BMPs. An evaluation of a limited number of existing management plans indicates a wide variation in plan content. This is due in some degree to the variety of agencies and individuals that have been involved in plan design. In general, the few plans reviewed (1978-80 vintage) seem to place more emphasis on odors and manure utilization than on water pollution control. For example, many plans provide no recommended pumping dates, holding times, or other important operation and maintenance factors, although they provide detailed calculations on nutrient value of manure, crop types, and similar information.

Soil, rainfall, and climate all affect impoundment function and design. In general, November through May is the wettest time of the year. A significant proportion of the annual rainfall may fall as snow, particularly in the eastern areas where elevation is higher and temperatures are cooler. In winter, frozen ground often prevents infiltration of rain or meltwater. It also prevents manure and runoff application on fields, resulting in the need to store manure during this period. Frozen ground can be expected for 2-3 months in the Caldwell and Twin Falls areas and 3-4 months in Pocatello. Spring runoff from accumulated snowfall, and even rainfall events spanning several days often produce a runoff volume that exceeds 25-year, 24-hour storm events (2.4, 2.8, and 2.1 inches for Caldwell, Twin Falls, and Pocatello, respectively)

Design criteria must adequately protect water quality but must not be so stringent as to place an excessive burden on the farmer. Given the financial state of many farmers, every effort should be made to attain this latter condition, perhaps by emphasing containment volume but avoiding requirements of high cost features such as concrete walls, liners, stainless steel piping, etc.

Previous design criteria (25-year, 24-hour storm) have not taken many factors into account. As a result, they do not accurately reflect local conditions, water quality degradation occurs, and impoundment functioning often does not meet the intent of the regulations. Design criteria must account for cumulative precipitation, frozen ground conditions, and wet-weather holding periods. Permit conditions or design criteria that focus only on the 25-yr, 24-hr. storm event will not be adequate to protect water quality.

Analysis of complaint data showed no correlation between daily rainfall events and complaints, but there was a strong correlation between complaints and the cumulative precipitation for 90- and 120-day intervals prior to the complaint. Weaker correlations also exist for 7- and 30-day antecedent precipitation. This supports the idea that design to contain single 24-hour events is not sufficient. A 4-month holding period is recommended.

Some volume adjustment can be made for evaporation, but the average annual evaporation rate is not a realistic measure to use because it is composed primarily of warm weather values (no winter data exist in Idaho), and evaporation rates in winter (the time when storage is needed) are much lower. Applying evaporation opportunity factors to the expected rainfall for months of winter storage produces a more realistic value.

The impoundment design criteria which appear to address the effects of frozen ground and cumulative rainfall conditions include design for a 120-day storage of runoff (based on an average 1-in-5 year winter for the months of storage) plus storage of a 25-year, 24-hour storm event and any process waste produced. No pond exfiltration should be assumed, and infiltration during frozen ground conditions should be assumed to be nearly 0.

These criteria alone will not prevent all overflows, particularly in very wet years, but they should perform adequately under most conditions. Implementation of solids separation should be encouraged (although not enforced) as it will greatly reduce odors in the impoundment and COD loading (should overflow occur). Proper maintenance, particularly seasonal emptying of impoundments, is at least equally as necessary as correct design. State personnel in all areas stress this need. Requiring each farmer under the permit program to submit a management plan would ensure that the farmer is aware of maintenance procedures and other BMPS and would also increase the chance of these practices being implemented.

NPDES General Permits have been issued for confined animal operations in Arizona, Utah, South Dakota, and Montana. Each program is implemented somewhat differently, but several generalizations on General Permits are possible. A General Permit will reduce initial paperwork and provide the appearance of a more uniformly administered enforcement program. On the other hand, a General Permit cannot cover all site-specific situations, and there is a danger that sources may "get lost" under a General Permit. General Permit issuance is feasible for Idaho, but it should not be expected that its issuance will automatically result in improved water quality or increase the number of operators expressing interest in the program. The effectiveness of any permit program ultimately depends on approach and degree of enforcement pursued by both EPA and the state, not on the form of the permit.

The regulations allow permit issuance under several conditions. Permits are required for feedlots and dairies of >1,000 or 700 animals, respectively. Feedlots and dairies of >300 or 200 animals, respectively, that discharge to waterways are also included in the regulations. The Appendix B regulations also allow permitting of any operation causing a water quality problem regardless of size. The sheer number of smaller facilities having <200 animals indicate that any permit and enforcement program aimed solely at the larger operations will be of limited value in water quality improvement. The best way to approach these smaller operations is probably to select and concentrate on priority drainages where water quality is impaired. Small farms essentially present almost a nonpoint source effect; effective control will require individual follow up and permit issuance if water quality improvement is to be expected.

Chapter 1

INTRODUCTION

Background and Purpose

A large number of confined animal feeding operations (primarily feedlots and dairies) are currently operating in Idaho. Their numbers, locations, the type and number of their treatment facilities, and the extent to which they cause water quality degradation have not previously been well documented. The Environmental Protection Agency (EPA) is required to regulate discharges from concentrated animal feeding operations by the Clean Water Act, P.L. 95-217, and regulations developed pursuant to the Act. A number of the larger feedlots and dairies were previously regulated by the EPA under the National Pollutant Discharge Elimination System (NPDES) program in the mid and late 1970s. The majority of these permits expired in 1979, although some were valid as late as 1982. The majority of these permitted dischargers are still operational, although many have changed ownership, expanded, or reduced their operation. Some have ceased operation, and a number of others have been identified which were either previously unpermitted or which have recently become established.

The EPA has established Effluent Guidelines and Standards for the feedlots point source category (Title 40, Part 412). As defined by Appendix B of the NPDES Regulations, these apply to large operations containing 1,000 or more slaughter steers and heifers; 700 or more mature dairy cattle; 2,500 swine; 500 horses; 10,000 sheep; 55,000 turkeys; 100,000 laying hens or broilers (with continuous flow water systems, or 30,000 with liquid manure handling systems); 5,000 ducks; or combined operations having 1,000 or more animal units. Under Appendix B of the NPDES Regulations, these numbers can be decreased to 300 slaughter cattle, 200 dairy cattle, 750 swine, 150 horses, 3,000 sheep or lambs, 16,500 turkeys, 30,000 or 9,000 laying hens (depending on the type of waste system), 1,500 ducks, or 300 animal units where either: 1) the pollutants are discharged into navagible waters through a man-made ditch, flushing system, or similar device; or 2) the pollutants are discharged directly into waters of the United States which originate outside of and pass over, across, or through the facility or otherwise come into direct contact with animals confined in the operation.

In addition, under Section 122.23, any operation can be designated a concentrated animal feeding operation on a case-by-case basis upon determining that it is a "significant contributor of pollution" to waters of the United States. Smaller facilities may therefore be regulated by permit as well. This possibility is of importance to this study because dairies are extremely numerous, a large number have no waste facilities, and the majority contain less than 200 animals. In some areas, the cumulative effect of these small operations has resulted in severe water quality degradation.

As of July 1984, the guidelines specify that existing facilities be required to meet Best Available Technology (BAT) standards, which have a 25-year, 24-hour rainfall event as the principal design criteria. They prohibit discharges to waters except when caused by a "chronic or catastrophic" rainfall event. New Source Performance Standards (NSPS) also require this criteria. Previously permitted facilities were normally designed to meet Best Practicable Control Technology (BPT), i.e., to contain processed waste plus runoff from a 10-year, 24-hour rainfall event.

Over the last several years, the number of both feedlot and dairy discharges, as well as the number of recorded complaints, has increased dramatically in Idaho. While this increase can be attributed to several factors, either singly or in combination, one main cause of the discharges appears to have been increased precipitation. A number of physical and climatic factors are related to the discharge of a system during a wet period, including whether the ground is frozen or not; amount, frequency, and duration of precipitation; amount of snow on the ground; and size and slope of the confinement area. All of these factors affect the volume of precipitation actually becoming runoff and entering an impoundment. Design requirements should permit an impoundment to adequately function given these variables. Management practices such as timing and frequency of impoundment drawdown are also critical to proper functioning and overflow prevention.

Several states, including South Dakota, Utah, Montana, Oregon, and Arizona, have or are presently considering using NPDES General Permits to regulate feedlots and dairies, rather than issuing individual permits to each facility. The EPA is presently considering the issuance of a General Permit in Idaho. As a change in the permit process is now being considered, this is an opportune time to review the appropriateness of impoundment criteria and to clarify the impact of physical and climatic variables on impoundment effectiveness.

A series of EPA aerial surveys has provided a variety of site-specific information on confined animals operations along the Snake River drainages where feedlots and dairies are most concentrated. The majority of Idaho feedlots and dairies lie within the survey area shown in Figure 1-1. For consistency, this report confines its assessment to the same areas. It assesses the number, type, and location of confined animal feeding operations and the degree to which they actually or potentially impact water quality. It also assesses the number of

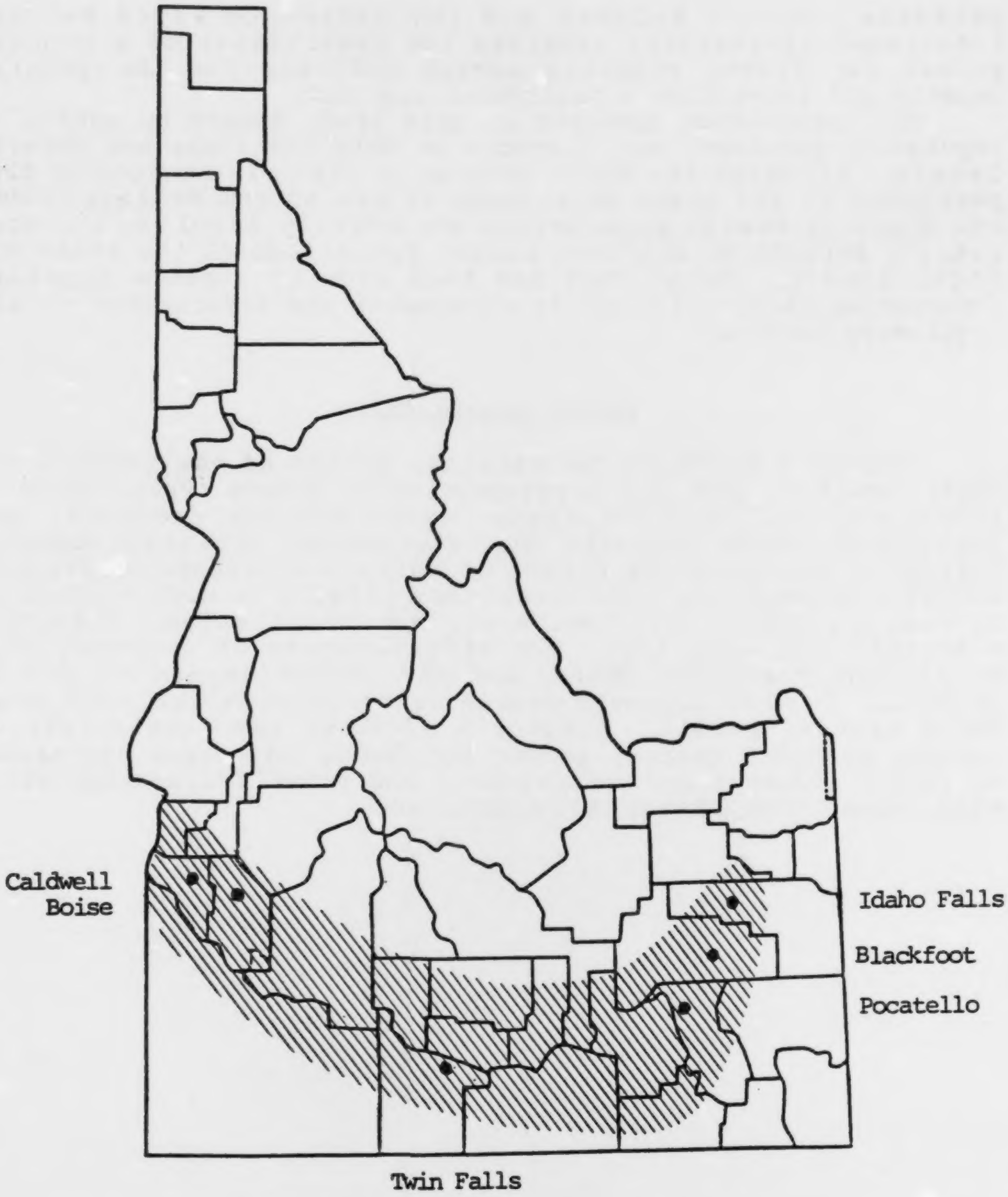

Caldwell
Boise
Idaho Falls
Blackfoot
Pocatello
Twin Falls

FIGURE 1-1. GENERAL LOCATION OF THE STUDY AREA

potential permit holders and the extent to which BAT has functioned adequately; examines the feasibility of a general permit for Idaho; suggests design criteria for the general permit; and identifies a management approach.

The information gathered by this study should be useful to regulatory personnel and planners at both the state and federal levels. Although the NPDES program in Idaho is managed by EPA, personnel in the Idaho Department of Health and Welfare (IDHW) and district health departments are heavily involved in water quality impacts of confined animal operations at the state and local levels. An attempt has been made to include baseline information which will aid in management and enforcement at all regulatory levels.

Report Organization

Chapter 2 assesses the existing status of the feedlot and dairy industry; provides a perspective on source types, numbers, locations, and feedlot-related water quality problems; and identifies water segments and sources of greatest concern. Chapter 3 discusses the effect of soils and climate on feedlot runoff and compliance and evaluates effects of such factors as snowmelt, precipitation patterns, and infiltration. Chapter 4 addresses the use, type, and effectiveness of existing Best Management Practices (BMPs) and the effectiveness of BPT in general. It also suggests design criteria to be included in an NPDES general permit. Chapter 5 assesses the feasibility of issuing an NPDES general permit for Idaho, discusses approaches to permit issuance and enforcement, and briefly discusses other enforcement/compliance alternatives.

Chapter 2

SOURCE ASSESSMENT

Although feedlots and dairies are scattered throughout Idaho, the great majority of feedlot and dairy operations are concentrated along the Snake River drainage in the Southwest Basin, Bear River Basin, and Upper Snake Basin of southern Idaho. This assessment concentrates on these areas and does not attempt to study or quantify operations within the state as a whole. It provides an overview of types and numbers of feedlots and dairies, their waste facilities and management practices, and factors influencing effectiveness of these waste facilities in southern Idaho. The conclusions are believed applicable to the entire state. In evaluating the current industry status and projecting feasible solutions, it is important to understand the historical, political, environmental, and economic factors affecting feedlot and dairy operations. For this reason, a brief overview and historical perspective are included here.

Historical Overview

Idaho has traditionally been an agriculturally-oriented state. The majority of the attitudes, economic conditions, and political forces revolve around and are integrated with agricultural interests and activities. It is not within the scope of this report to provide an in-depth socio-economic analysis, but it is important to understand the impact and relationship that these factors have on dairy and feedlot operators. Without this understanding, it is unlikely that workable management strategies can be devised or effectively implemented. This section briefly summarizes some of the more important factors influencing dairy and feedlot management and regulation in general. Conditions in the individual study areas are described in subsequent sections.

Feedlots differ from dairies in their geographical areas of concentration, average size, and total numbers. The number of animals in a feedlot can greatly exceed those found in a dairy, but the U. S. Department of Agriculture Statistical Reporting Service (SRS; Hasslen pers. comm.) estimates there are nearly 15 times as many dairies (2,500) in the state as feedlots (175). Most of the large feedlots are centered in the Boise-Caldwell vicinity. There are relatively few in the other areas. In contrast, dairies are concentrated in the vicinity of Twin Falls and Blackfoot. Although they are of smaller size than feedlots (generally <200 animals), sheer numbers make dairies a prime concern in these areas.

Much of the growing concern over dairies is due to a change in both size and number of operations. The typical dairy of the past was a family operation, having perhaps 60-90 animals. It was operated for self sufficiency, and there was little impetus for expansion. Most operations were built near canals or waterways, which served both to provide water and remove wastes (Collings pers. comm.).

Today's dairies are larger, with most having 150-200 animals. These are commercial operations, and they tend to produce much greater waste volumes than the older operations (Collings pers. comm.). Unlike feedlots, the number of dairies has increased greatly over the last few years. The number of dairy cows in Idaho increased by 23 percent between 1978 and 1982, with the majority of growth occurring in the Magic Valley area (IDHW 1984a). Centered around Twin Falls and Wendell, Magic Valley spans the area from Rupert to Bliss, extending northward to Shoshone and southward to the Idaho border. It now contains over 40 percent of the state's dairy herd (IDHW 1984a).

Many of the new dairymen are Dutch farmers who have moved from California's Chino Valley. The chief attractions in Magic Valley appear to be cheap land and feed costs and little environmental regulation (Collings, Renk, McMasters pers. comm.). Other conditions also differ, however. A combination of frozen ground and snowmelt result in large volumes of spring runoff, a situation not encountered in the drier climate of Chino Valley. If this climatic factor is not taken into account when designing waste lagoons, or if it is not alleviated by more frequent pumping, discharges will occur. Failure to understand this difference in climatic conditions may be one of several reasons why waste systems fail.

Dairies are classified as grade A or grade B dairies. Grade A dairy products are suitable for direct consumption, in forms such as milk and cream. Grade B dairy products are used in processed foods, such as cheese and ice cream. There is substantial incentive for a dairy to achieve grade A status because milk prices are higher for grade A milk (presently approximately $12.50 versus $13.88 per hundred pounds of milk) (Collings pers. comm.).

There tend to be fewer wastewater problems with grade A dairies because these dairies require a permit and are inspected by the Health Department. To obtain grade A status, a dairy is required to have adequate wastewater disposal facilities. Enforcement is still a problem, however, because "adequate" facilities are not defined and Idaho regulations provide no penalties for violations. The Pasteurized Milk Ordinance has penalties, but dairies in Idaho do not operate under this ordinance (Collings pers. comm.). The degree to which a grade A dairy can be made to install environmentally sound wastewater facilities is thus somewhat limited.

Grade B dairies produce approximately 70 percent of the milk. Although they are perfunctorily inspected by the Department of Agriculture, they are very loosely regulated because they are not required to obtain permits. Consequently, it is very difficult for the Department to require anything. Most dairy waste problems tend to be associated with grade B dairies (Palmer, O'Rourke pers. comm.).

Unlike feedlots, dairies produce large amounts of process wastewater on a year-round basis in addition to precipitation-caused runoff from cowyards. Opinions concerning the relative importance of runoff and process waste discharge vary with the area and individual. Some state and local personnel feel the two discharges are of approximately equal importance. Others feel the process waste is far more important, and still others place greater emphasis on the runoff. At present, if a dairy does have waste facilities, they are often designed only for process waste. Runoff containment has, for the most part, been essentially ignored by both grade A and grade B dairies.

Canals have an important relationship to confined animal operations in many areas. This appears to be particularly true in the Magic Valley area, where over 1-million acres of farmland are irrigated by over 3,000 miles of canals and laterals (IDHW 1984a). In this area, canals, rather than streams or rivers, receive the majority of identified discharges. The one clear-cut enforcement tool for dairy and feedlot discharges is related to canals. Idaho Code Section 18.4301 "Interference with Ditches, Canals, or Reservoirs" prohibits discharge of filth or other materials or obstruction to the free flow of water. The canal companies are generally reluctant to enforce this Section, however, because the dairymen are stockholders in the canal company (Hopson, Collings pers. comm.). Letters in the IDHW files indicate at least two canal companies have occasionally sent letters to violators, but there was little evidence of serious follow up; the canal companies tend to look to IDHW or the Health Department for enforcement (Hopson, Renk, Collings pers. comm.).

Fish hatcheries may also come into conflict with waste discharges from dairies and feedlots, particularly in the Twin Falls vicinity. The Magic Valley area contains approximately 100 hatcheries and produces approximately 90 percent of the nation's commercial trout (IDHW 1984a). Most are raised in individual ponds using water from springs in the rocks or from streams and canals. The direct discharge of wastewater and corral runoff has caused fish kills. Although kills are relatively infrequent, they are costly, as hundred or thousands of fish may be affected. In addition, dairy wastes induce weed growth in canals. Weed killer used to control this growth has also been responsible for a number of documented fish kills. Hatcheries are located primarily in Gooding County, with most near Hagerman and Buhl (O'Rourke, McMasters pers. comm.).

A number of other factors also contribute to both dairy and feedlot enforcement problems. Just as there is no well-defined state mechanism for ensuring proper design of a waste facility, similarly there is no enforcement procedure for improperly designed facilities. IDHW can review plans but is not required to approve them, and animal waste regulations have not been able to pass the legislature (McMasters pers. comm.). When systems are properly designed, often they are designed primarily to serve existing conditions rather than to meet requirements of a farmer's long-range goals. A system designed for an existing operation may therefore become undersized if the farm expands. There is no local mechanism for ensuring farms that increase their animal densities provide a corresponding upgrade in facility size. A lack of regulation to prevent groundwater pollution and a high percentage of absentee landlords are also concerns.

A number of agencies provide technical assistance to dairy and feedlot owners. The SCS provides technical assistance in planning and designing to non-commercial dairies and feedlots. The Agricultural Stabilization and Conservation Service (ASCS) may provide up to $3,500 in direct financial assistance for cost-sharing and the installation of BMPs.

The SCS-designed facilities function well when built according to plan, but they can be quite expensive. The narrow profit margin of the farmer often makes construction costs prohibitive because the $3,500 in financial assistance may cover only 5-10 percent of the expected cost for some facilities. Many designed facilties are therefore never built. Other designs have been structurally altered to cut costs, although when cost-sharing is involved, facilities must be built to SCS specifications. Although plan alteration may sometimes affect efficiency, IDHW has reviewed some altered systems which are simply dirt ponds with a cement floor and ramp. They appear to function properly while reducing cost by 50 percent (Hopson pers. comm.). In the late 1970s, both SCS and IDHW placed greater emphasis on system design. The files indicate a substantial decrease in facility design since about 1980, and both IDHW and SCS personnel indicate design activity has slacked off in recent years (Davidson, Hopson, James pers. comm.).

The ASCS has provided 75:25 cost share assistance for water quality projects under the Rural Clean Water Program (RCWP). One RCWP project presently operates in the Rock Creek area; unfortunately, no new districts are being designated at present. One problem with this type of program is that, like individual systems, it tends to be effective only while the program continues. Once the program ends, many people believe structural maintenance tends to end and soon many of the benefits are lost (Burkett pers. comm.).

Some local associations, such as the Wood River Resources Association of Counties, also provide financial assistance to local operators. Still another assistance program includes a computer program available through some of the county extension agents. The program designs waste lagoons providing for 5-month capacity with a 3-foot freeboard.

All IDHW districts identified the maintenance issue as perhaps the greatest obstacle to water quality where wastewater containment facilities already exist. Some regulators feel pond sizing is relatively unimportant if the operator pumps the pond as necessary to prevent overflow. Because climatic conditions restrict pumping of facilities during winter months, designing to allow sufficient storage volume for these periods is important; but the maintenance aspect must not be overlooked. Operator ignorance is not the reason discharges occur. Many operators simply find pumping of lagoons an inconvenience. Water pollution fines are rare, and if levied under state legislation, are small and generally easier to accept than construction of additional facilities or increased maintenance (Allred pers. comm.). Some SCS personnel that work state-wide believe that, in general, more awareness or concern exists in southern Idaho than in the northern panhandle. This may be due in part to the greater concentration of operations in the south and the resulting increased emphasis on feedlots and darries by SCS and IDHW.

All agencies indicated one of the greatest problems is lack of field personnel and inspectors. This is certainly both a valid concern and an important issue which must be addressed. In some cases, it is a very real constraint to enforcement; in others, it may be a convenient excuse for lack of enforcement. The personnel lack will become more evident if a functional permit program is established. Increasing the involvement of other agencies and groups, such as the district health departments, would help to offset the manpower shortage in IDHW and SCS.

A Statewide Perspective on Feedlots and Dairies

The aerial survey was not meant to identify or locate all feedlots and dairies. It was designed to cover the areas of greatest feedlot and dairy concentration and areas where animals affect water quality. Because water quality problem areas do exist outside of the study area, however, and because a general permit would cover the entire state, it is important to develop a statewide perspective on feedlots and dairies.

The USDA SRS (Hasslen pers. comm.) reports 175 beef feedlots and approximately 2,500 dairies operating in Idaho in 1983. Table 2-1 provides a breakdown of the feedlots and dairies by size. SRS defines a feedlot as an operation having a holding area and animals on feed for slaughter and bases the facility size estimates on capacity not actual number of animals. Operations tabulated are considered to be commercial operations.

It can be seen from the table that by far the largest number of feedlots are operations of <1,000 animals. The large number

Table 2-1. Number of Feedlots, Dairies, and Animals Reported for the State of Idaho (1983)

FEEDLOTS		DAIRIES		
# ANIMALS	NUMBER	# ANIMALS	NUMBER*	
<1,000	120	1-29	65%	[1,625]
1,000-1,999	16	30-49	11.8%	[295]
2,000-3,999	15	50-99	16%	[400]
4,000-7,999	11	>100	10.7%	[26]
>8,000	13			
TOTAL	175		102.5%	~2,500

---

* Statistics available for dairies record categories as percent and estimate total number at approximately 2,500. Figures in brackets are estimated.

SOURCE: Statistical Reporting Service (Hasslen pers. comm).

of small operations identified by aerial survey indicates that the number of feedlots within the SRS "<1,000" category is still an underestimate; it is probable that many of the smaller operations in this category have been missed, particularly those in the <50 and 51-200 size ranges.

This assumption is supported by the fact that SRS also reports a total of 890,000 beef cattle within the state during 1983. Using the SRS size class data, assuming each identified feedlot contained the largest possible number of animals for its size class (with those in the ">8,000" class counted as having 8,000), the total number of animals accounted for would be approximately 400,000 (only 21 percent of the total). To account for such a large number of animals, the 13 identified feedlots in the largest size class must either have many more than 8,000 animals, or there are a large number of smaller operations that have not been identified. It is most likely that many smaller operations have been omitted.

It is difficult to equate results of the aerial survey with the SRS information because size classes used by the two sources differ. As the larger operations are more visible, however, it is likely that the number of operations in the larger size classes is more accurate than the number for smaller size classes. The SRS identified a total of 55 feedlots having over 1,000 head. The aerial photo survey identified only 17 operations of this size. Either the remaining feedlots are outside of the study area, they are within the area but were missed by the survey, or they were included in the survey under an incorrect size category. As the number of animals vary within a feedlot throughout the year, this last possibility is quite likely. The greatest discrepancy between survey and SRS data, as expected, falls in the smallest size class.

The SRS reports dairies somewhat differently than feedlots. The total number of dairies is estimated at approximately 2,500, and the number of operations within a class is given as a percentage rather than an actual number. As with feedlots, the majority of dairy operations are in the smallest size class. Using the percentage and estimated total number of dairies, over 1,600 dairies can be calculated as belonging in the 1-29 animal size class. These figures seem to correspond to the aerial photo information better than the feedlot figures.

The SRS reports 172,000 dairy cows within the state. Assuming each dairy contained the maximum number of animals for its size class (with those in the >100 class counted as having 100), the total number of animals accounted for would be approximately 96,000 or 56 percent. Again, this seems to indicate that either a large number of operations have been missed by the SRS or that many of the 26 dairies within the ">100" class have a much larger number of animals than 100. Regardless of the actual number, however, the large number of operations identified has implications for water quality as well as for the permit process. The sheer number of smaller facilities identified (probably a large underestimate in both the aerial survey and the SRS data) indicates that any permit and enforcement procedure aimed solely at the larger operations will be of limited value in overall water quality improvement. These small operations are so numerous they produce almost a nonpoint source effect and contribute significantly to water quality degradation. Any program developed must address these smaller sources if significant improvement is to be expected.

Study Area and Methodology

As a first step in assessing the number and condition of existing operations, EPA conducted aerial photographic surveys (EPA 1984a, b,c, and EPA 1985) within the Southwest, Upper Snake, and Bear River Basins and located in the general vicinity of Caldwell, Twin Falls, and Blackfoot. The surveys concentrated primarily on the Snake River and its tributary streams and rivers because of the large number of operations located in this area. The methodology for aerial survey coverage was somewhat different in each of the three survey areas because of differences in information available for each region. Results from the three areas are therefore not totally comparable, but together they provide a great deal of information on the distribution of confined animal operations within southern Idaho. Over 20 counties are included in the survey area.

In all three surveys, operations were screened by size to limit the number requiring greater depth of analysis. The surveys included all dairies having more than 25 animals or larger than 3 acres in size and all feedlots having more than 50 animals or larger than 10 acres. In the Blackfoot and Twin Falls areas, criteria also included any operation where cattle had direct access to water, regardless of size (Becker pers. comm.). Although many of these operations are relatively small, they can potentially cause severe water quality degradation if waste management facilities are unsatisfactory. Their cumulative impact can be substantial. Understanding the smaller operations is critical in estimating magnitude of animal impact and providing insight into management of the entire dairy and feedlot industry.

EPA further assessed each screened source in the aerial study by using stereoscopic analysis to determine water pollution potential. The slope and direction of runoff, distance to surface water, number and size of impoundments, feeding area acreage, animal count, and access to surface water were determined for each source. Drainage direction was determined from photographic analysis and U. S. Geological Survey maps. Owners were also identified by use of plat maps and property records.

Information from EPA aerial surveys was used in assessing and quantifying sources as part of this study. This information was supplemented by information from the EPA NPDES permit and compliance files, the Idaho Department of Health and Welfare (IDHW), district health department, and Soil Conservation Service (SCS) files. Personal contact with various state and district Soil Conservation Service (SCS) personnel, the district Health Departments, IDHW technicians and engineers, and Conservation District personnel also provided information on the current status of individual operations, factors affecting construction and enforcement of facilities, and the effectiveness of BPT and other management practices on previously permitted facilities. A literature review of relevant soil and climatic data was also performed to provide baseline data for the development of design criteria. A number of personal communications with EPA and state personnel provided information on NPDES General Permits and various management approaches.

Source Quantification

Because the study area lies within the jurisdiction of three IDHW district offices, and because the aerial survey coverage and methodology varied slightly with each survey, the sources are discussed below by survey location. This division generally corresponds to drainage basins and stream segments as well as to IDHW district jurisdictions.

Several factors complicated data compilation and assessment. A number of feedlots or dairies sometimes exist under the same ownership, which has sometimes led to confusion in the records. Simplot, for example, had six previously permitted operations, all similarly named, and several are located in the same vicinity. Analysis of file information relating to these operations was hindered because local correspondence, complaints, and inspection reports often did not provide permit numbers or other sufficient information to allow identification of the exact operation involved. In other cases, information was conflicting; names did not match permit numbers for example. Name changes were another confusing factor. Feedlots or dairies may exist in files under two or more names because they have changed ownership over the years or because they were alternately referred to by owner's name and corporate name.

Even determining which facilities were previously permitted proved unexpectedly complicated. A number of different permit listings exist in various agency files. None was found to be complete (the EPA listing was incomplete due to incorrect computer coding of a SIC category). A number of operations received permit numbers but were later exempted or the permit was cancelled. After data and record compilation, 68 valid feedlot and dairy permits were found to have been previously issued for Idaho: 37, 20, and 10 for the Caldwell, Twin Falls, and Blackfoot study areas, respectively. Only one operation was located elsewhere (Salmon area), indicating that the area of major concern has been largely covered by the survey, although numerous smaller operations are scattered throughout the state. IDHW file records indicate at least 11 other operations also received permits that were later exempted or cancelled. These operations are included in this Chapter (Table 2-15) primarily as an aid to state personnel in record and status clarification. Nearly all of these are located in the Caldwell area.

The strong agricultural orientation and politics within the state also affected the assessment to some degree. The perception of dairies and feedlots varies widely from person to person. Few people are neutral; either they view the industry as having great impact on water quality and they are working diligently to reduce impacts, or they tend to minimize the impacts, take a more unconcerned approach to complaints and enforcement, and assume that little change can be accomplished because of the political climate. In the latter situation, there tends to be little information available in files or voluntered orally. In cases where the magnitude of the impact appears to be understated, the aerial survey information helped to offset the lack of information.

Caldwell Area (Wieser to Glenn's Ferry)

The Caldwell area contains more than half of the previously permitted operations, yet the aerial survey identified relatively few operations compared to the other two regions. This is due primarily to survey methodology, as the aerial survey area was selected to focus on known feedlot and dairy problems, rather than to provide blanket coverage of the entire region. Most operations surveyed in the Caldwell area were large. That the survey identified a smaller number of sources in this area does not necessarily indicate a less severe problem; in fact, the reverse situation may be true because the greatest number of large operations exist here. In the other two study areas, operations with access to surface water, regardless of size, were included. If this were the case in the Caldwell area as well, the total number of aerially surveyed operations would have been much greater (Becker, Clark pers. comm.).

Sources Identified Through Permits and Aerial Survey. The Caldwell area is the only study area where feedlots appear to greatly outnumber dairies; nearly all of the larger previously permitted feedlot operations are located here. The 30 feedlots and seven dairies or poultry operations previously permitted for the Caldwell area are shown in Table 2-2. The surveyed operations (generally large operations only) appear to be widely dispersed; Nampa and Caldwell contained five operations each, followed by Payette, with three. Bruneau, Marsing, Meridian, Emmett, Eagle, Wilder, Grandview, Parma, and Boise each contained two; and Hammett, Homedale, Middleton, Wieser, Melba, and Notus each contained one.

The aerial survey identified 25 feedlots, 5 dairies, and 1 poultry operation. Of these, 20 feedlots and 5 dairy or poultry operations previously held permits. Approximately 33 percent of the feedlots (10 operations) and 30 percent of the dairies (two operations) previously permitted were thus not included in the

Table 2-2. Previously Permitted Operations in the Caldwell Area

PERMIT NUMBER	EXPIRATION DATE	NAME[a]	AREA	RECEIVING WATER	RECORDED COMPLAINTS
		PERMITTED FEEDLOTS			
002307-8	6/13/79	*Armour & Company	Nampa	Boise R (via Indian Cr)	
002132-6	6/21/79	*Bivens Livestock Co.	Payette	Wieser R (via L. Payette Canal)	12/13/83
002147-4	6/21/79	*Bower Feedlot	Marsing	Snake R (via Ischam Drain)	12/14/83
002133-4	5/28/79	*Bruneau Cattle Co.	Bruneau	Snake R (via Jacks Cr)	
002214-4	6/21/79	*Clayne Cooper (C. M. Ranch)	Emmett	Payette R	
002188-1	5/28/79	*Don McGhehey (Theodore J. Stutz; Mule Shoe Bar Ranch)	Hammett	Snake R	
002593-3	--	Drees Feedlot	Homedale	Drainage ditch	
002174-1	6/21/79	Emmett Feedlot, Inc. (Holstein Heifer Ranch; Emmett Cattle Corp.)	Emmett	Payette R	~5/9/73
002272-1	6/20/79	*Farmer Cattle Co.	Marsing	Snake R (via Wilson Cr)	
002195-4	6/21/79	*George Ray Obendorf Feedlot (Ray Obendorf Feedlot)	Parma	Snake R	
002472-4	6/2/82	*H. H. Keim Co., Ltd.	Nampa	Indian Cr	
002115-6	5/28/79	*Holbrook Ranches, Inc.	Bruneau	Snake R (via Jack & Little Jack Cr)	
002211-4	6/4/79	*I.O.N. Cattle Company, Inc.	Middleton	Boise R	
002153-9	6/21/79	*Idaho Feedlot Co.	Wieser	Snake R	
002154-7	6/21/79	*Idaho Feedlot Co.	Star (Eagle)	Boise R	Numerous in 1974, 75, 76, 78, 79, 80, 82, 83, 84
002162-8	6/21/79	Idaho Meat Packers, Inc.	Caldwell	Boise R & Indian Cr (via drains)	
002163-6	6/21/79	*J. Howard Kent Beef Feedlot (Kent Ranch Co.)	Caldwell	Boise R (via Sidenberg Canal)	
002197-1	6/21/79	*Johnson Cattle Co., Inc.	Wilder	Snake R	2/12/79
002220-4	6/21/79	Lone Star Cattle Co., Inc.	Nampa	Boise R	
002246-2	6/21/79	P&B Feedlot, Inc.	Melba	Snake R	
002300-1	6/13/79	*Quarter Circle DJ Ranch	Eagle	Boise R (via Foothill Ditch)	
002131-8	6/11/79	R. L. Cattle Company	Nampa	Boise R (via drain canal)	
002471-6	6/2/82	Richard D. Rutledge	Caldwell	Boise R (via Hartley Gulch Cr)	2/15/80
002218-7	6/21/79	*Simplot Feedlots, Inc. (#3)	Caldwell	Boise R (via ditch)	12/14/83; 2/13/84
002216-1	10/31/79	*Simplot Livestock Co. (Simplot Feedlot #1)	Grandview	Snake R (via canal)	3/30/84

Table 2-2. Continued

PERMIT NUMBER	EXPIRATION DATE	NAME[a]	AREA	RECEIVING WATER	RECORDED COMPLAINTS
			PERMITTED FEEDLOTS		
002217-9	10/31/79	Simplot Livestock Co. (#2)	Boise		
002458-9	6/2/82	*Tiegs Farm, Inc.	Nampa	Indian Cr	
002235-7	6/21/79	*Western States Cattle Company	Notus	Boise R	
002196-2	6/21/79	Wilder Cattle Co.	Wilder	Boise R	
002233-1	6/21/79	Higby Cattle Co. (Wright Cattle Company)	Payette	Payette R (via Willow Cr)	
			PERMITTED DAIRIES/POULTRY		
002282-9	6/4/79	*American Dairy Heifers (Columbia R. Assoc.)	Payette	Snake R (via Payette R)	
000040-0	3/30/79	Boise Associated Dairies	Boise	Boise R	
002374-4	9/26/79	Dari Vest Farms, Inc. (Case Visser Dairy)	Parma	Snake R	
002447-3	6/30/80	*Hank Vanderwey Dairy Farm	Caldwell	Boise R	5/6/75; 2/27/77; 12/12/78; 1/5/79; 2/26/79
002215-2	6/21/79	*Simplot Poultry, Inc. (dba Valley Storage Co.)	Meridian	Lake Lowell (via Ridenbaugh Canal)	
002219-5	6/21/79	*Simplot Poultry, Inc. (dba Intl. Cattle Exports)	Meridian	Boise R	
002116-4	5/28/79	*Triangle Dairy, Inc. (Caldwell Dairy)	Grandview	Snake R (via Shoofly Cr)	6/29/83 (operational problems)

---

* Identified Volume 1 of the aerial survey (EPA 1984a).

[a] Names in parentheses indicate previous name or other identifying name under which information exists in IDHW files.

SOURCES: EPA and IDHW files.

Caldwell aerial photo survey. The survey did, however, identify five additional feedlots and one additional dairy operation in the survey area that were not previously permitted but which were important enough to IDHW personnel to include in the survey. Table 2-3 summarizes results of the aerial survey, gives locations and receiving water segments, and indicates which operations were previously permitted. Hundreds of smaller feedlots and dairies are also present but not covered by the aerial survey (Clark pers. comm.). It is assumed that most of the permitted operations not identified in the survey still exist, although some may be under different ownership.

Only 22 feedlots, dairies, and poultry operations having over 200 animals were identified by aerial survey in the Caldwell area. Only 11 had over 1,000 animals. Care should be taken, however, not to overemphasize the importance of numbers or to equate them too closely with expected impact. The number of animals in an operation may vary widely, depending on whether animals are being readied for market or whether they have just been sold. Numbers also vary from year to year. It should also be noted that the aerial survey occurred in the last half of April. Animals are generally confined only from October or November to April. If cattle or sheep were on BLM rangeland at the time of the survey, the confinement areas would be empty. This was true in the Twin Falls area (Morrison pers. comm.) and may be the case in the Caldwell area as well. Numbers will thus not provide a reliable indication of potential impact, except in a relative sense as they compare to numbers in other areas if all other factors are equal. Land slope, BMPs, location and many other factors are also critical in determining the impact an operation will have on receiving water.

Access of cattle to water is perhaps one of the most critical factors in determining feedlot and dairy impact on water quality. Thirteen of the 31 operations surveyed permit cattle to have direct access to streams. This results in trampling of streambanks, greatly increasing bank erosion. It also results in direct input of manure to the water. Furthermore, permitting access produces a year-round impact, unlike impacts from overflowing facilities which are primarily rainfall related. Cattle access to waterways for drinking water is established by state law (Idaho Code section 42-113), and total elimination of access would be difficult. It should be possible to restrict access to much smaller areas, however, and to encourage fencing and watering tank installation where possible.

Sources Identified Through Complaints. IDHW maintains general files on feedlots and dairies, dating back in some cases to 1973. These were reviewed to determine the sources, areas, and times when water quality complaints were received (odor and fly complaints were disregarded). Nearly 70 water quality-related feedlot and dairy complaints were received by the Boise IDHW district office from 1975 to June, 1984. Health departments also receive complaints, but they are primarily related to flies

Table 2-3. Confined Animal Feeding Operations Identified by Aerial Survey in the Caldwell Area

SITE NO.	NAME[a]	FEEDING AREA (AC)	NO. ANIMALS[b]	RECEIVING WATER [c]	ANIMAL ACCESS/ PEN DISTANCE TO WATERWAY (FT)	SLOPE[m]	IMPOUNDMENTS (#, ACRES)	LOCATION
	FEEDLOTS							
1	Idaho Feedlot*	50	<50	None	None/--	F	3; 1 AC	Wieser
3	Bivens Livestock Co.*+	32	>1000	SWB 420[l]	None/56	M/S	None	Payette
4	-----	26	201-700	SWB 340[d]	None/85	M	None	Homedale
5	C. M. Ranch*	18	201-700	SWB 340	Direct access	M/S	None	Emmett
6	Hilltop Feedlot	60	>1000	SWB 30	None/570	M/S	10; 5 AC	Nyssa
7	George Obendorf*	29	<50	None	None/1300	M	None	Parma
8	Western States Cattle Co.*	15	201-700	None	None/25	F	3; 0.2 AC	Notus
9	Simplot Feedlots, Inc.*+	300	>1000	SWB 280	None/10	F	16; 12 AC	Caldwell
10	Johnson Cattle Co., Inc.*	78	<50	None	None/42	F	None	Wilder
12	Bower Feedlot*+	15	>1000	SWB 20	None/40	S	None	Marsing
13	____________[n]	13	201-700	SWB 20[e]	Direct access	F/M	None	Homedale
15	I.O.N. Cattle Company, Inc.*	22	<50	SWB 270	Direct access	F	None	Middleton
16	Kent Ranch Co.*	60	>1000	SWB 280	Direct access	F	3; 2.3 AC	Caldwell
17	H. H. Kiem Company, Ltd.*	10	201-700	SWB 280[f]	None/20	F	None	Nampa
18	Armour & Company*	11	201-700	Canal	None/20	F	None	Nampa
19	Tiegs Farms, Inc. #1*	7	201-700	Lk Lowell[g]	None/20	F	None	Nampa
20	Tiegs Farms, Inc. #2	4	201-700	Lk Lowell(?)	None/20	F	None	Nampa
21	Idaho Feedlot Co.*+	192	>1000	Irg. ditch	Direct access	F	4; 2.5 AC	Eagle
22	Quarter Circle DJ Ranch*	7	<50	Canal	None/10	F	None	Eagle
25	Farmer Cattle Co.*	75	>1000	SWB 20[h]	Direct access	F	7; 2 AC	Marsing
26	Hackler Feedlot	30	>1000	SWB 20(?)	Direct access	F	None	Marsing
27	Simplot Livestock Co.*+	200	>1000	Irg. ditch	Direct access	F/M	None	Grandview
29	Bruneau Cattle Co.*	80	>1000	SWB 10[j]	Direct access	F	None	Bruneau
30	Holbrook Ranches*	26	>1000	SWB 10[j](?)	None/10	F/M	None	Bruneau
31	Don McGhehey*	5	<50	SWB 10[k]	Direct access	F/M	None	Hammett
	DAIRIES AND POULTRY							
2	American Dairy Heifers #1*	47	700-1000	SWB 340	Direct access	F	3; 1.5 AC	Payette
11	Owyhee	7	51-200	SWB 20	None/47	M/S	1; 0.8 AC	Homedale
14	Hank Vanderwey Dairy*+	18	201-700	None	None/10	F	1; 0.6 AC	Caldwell
23	Simplot Poultry #1 (Poultry)*	-	<50(?)	Riden. C.	Direct access	F	None	Meridian
24	Simplot Poultry #2 (Dairy)*	-	<50	Irg. ditch	Direct access	F	None	Meridian
28	Triangle Dairy*	35	>1000	SWB 20[i]	None/135	F	None	Grandview

---

[a] * = Permitted; + = Water quality complaint received by IDHW.

[b] It should be noted that number of animals may vary substantially depending on time of year.

[c] SWB 420 - Wieser R (Midvale to mouth)
SWB 40 - Snake R (Payette R - Brownlee Reservoir)
SWB 340 - Payette R (Black Canyon Dam to mouth)
SWB 30 - Snake R (Payette R to Boise R)
SWB 280 - Boise R (Caldwell to mouth)

Table 2-3. Continued

SWB 270 - Boise R (Mile 50 : Vet St. Park - Caldwell)
SWB 20 - Snake R (Strike Dam to Boise R)
SWB 271 - Ten Mile Cr, Five Mile Cr
SWB 282 - Indian Cr (below Nampa)
SWB 10 - Snake R (King Hill - Strike Dam).

[d] Via Big Willow Cr
[e] Via Jump Cr
[f] Via Indian Cr
[g] Via New York Canal
[h] Via Reynolds Cr
[i] Via Shoofly Cr
[j] Via Little Valley Cr
[k] Via Cold Spring Cr
[l] Via L. Payette ditch
[m] F = flat; M = moderate (5-10 percent); S = Steep (>10 percent).
[n] Mistakenly identified as "Steve Drees" feedlot in aerial survey report

SOURCES: EPA 1984a; IDHW files.

and odor, not water quality. Complaints are summarized by year and source in Table 2-4.

Several factors should be noted in reviewing information in Table 2-4. First, the number of complaints is not necessarily an indication of the magnitude of the water quality problem. For a number of reasons, complaints are often not lodged, even though a water quality problem may exist. Fear of offending a neighbor, unobserved violations, lack of concern, resigned acceptance of a problem, lack of personal impact, isolation of a source, or other factors all combine to make complaint figures high underestimates of the actual problem magnitude. Second, enforcement and recording procedures were not well established in the early 1970s and much file information for these years is incomplete or absent.

A few sources cause repeated discharges. When several complaints relate to one operation in a single year, only one complaint is indicated in Table 2-4 because an attempt was made to determine the number of operations generating complaints within a year, rather than to determine the total number of complaints. Some operations considered problems were corrected; complaints in later years cannot be assumed to refer to the same source that caused complaints in previous years. Files and complaint information are not standardized and much information is incomplete. It is therefore difficult to determine follow-up action or consecutive discharges from a single facility because each complaint does not have a separate file. Given all of the above factors, data in Table 2-4 should be considered only in a relative sense. Data do, however, indicate a rising number of complaints, particularly over the last 4 years.

Approximately 55 percent of the complaints relate to "non-identified operations", i.e., operations neither previously permitted nor identified in the photo survey. Eight of the operations received complaints in at least two different years, and some appear to be chronic dischargers. A disproportionately large number of complaints were for dairies. One reason for this may be that dairies discharge at least milk-barn waste year-round, and this discharge would more likely be noticed than feedlot discharges, which tend to be precipitation related.

The complaint data indicate that most of the feedlots causing problems (and therefore needing permits) appear to have been identified in the Caldwell area. A number of dairies not identified either through the survey or through a previous permit create potential problems. Although some of these operations are relatively small, they should be reviewed for permit applicability because of past violations. Contact was made with the IDHW personnel to determine the size and present status of these operations where possible. A partial list of these non-identified farms potentially requiring a permit is given in Table 2-5.

Table 2-4. Summary of Complaints Received by IDHW for Confined Animal Operations in the Caldwell Area (1973-1984)

	COMPLAINTS FOR FACILITIES IDENTIFIED BY SURVEY OR PERMIT		COMPLAINTS FOR ADDITIONAL FACILITIES	
	FEEDLOT	DAIRY	FEEDLOT	DAIRY
1973	1	-	-	-
1974	1	-	-	1
1975	1	1	-	-
1976	-	-	-	-
1977	1	1	-	-
1978	1	1	1	2
1979	4	2	2	2
1980	2	-	1	-
1981	-	-	1	4
1982	1	-	3	6
1983	7	1	3	3
1984	4	1	1	6

SOURCE: IDHW files.

Table 2-5. Additional Dairies and Feedlots Potentially Requiring Permits in the Caldwell Area[a]

NAME	LAST KNOWN APPROXIMATE SIZE	LOCATION	TYPE
Haines Bros.	50	New Plymouth	Dairy
Harold Boschma	500	Kuna	Dairy
Sieben Roukema (or new owner)	50-100	New Plymouth	Dairy
Mike Miller	50	New Plymouth	Dairy
Van Beek Dairy	200	Payette County	Dairy
Beckman Feedlot	500	Horseshoe Bend	Feedlot
Stovers	500	New Plymouth	Feedlot
Joe Zabala	100-200	Boise	Feedlot
JMK Farms	100-200	Meridian	Feedlot
Ed Deboer	100-500	Meridian	Feedlot
Jerry Tlucek	200	Melba	Dairy
Holstein, Inc. (formerly Stevens Dairy)	150	Black Cat	Dairy
Theron Scott	100-200	Meridian	Dairy
Steve Drees	up to 4000	Homedale	Feedlot
Gary Thomas	100	Emmett	Dairy
Wayne Russel	50-100	Emmett	Dairy
Steve Thayn	50-100	Emmett	Dairy
Gene Atkinson	800	Emmett	Feedlot

---

[a] As established from complaint files and discussions with state enforcement personnel. These facilities are in addition to those previously permitted or identified by photo-survey. This list should not be considered a complete list.

Status of Previously Permitted Operations. Table 2-6 summarizes the relationship between permits, impoundments, and complaints for the Caldwell vicinity. It is worth noting from Table 2-3 that approximately 72 percent of the surveyed feedlots do not have impoundments, and 40 percent have direct access to a waterway. Feedlots in the Caldwell area were primarily large operations. If smaller operations had been included, the percentages of farms having no impoundments and direct access would probably be higher. Previous permitting had little impact on impoundment construction in the Caldwell area. The percentage of permitted operations with impoundments (32 percent) is essentially equal to the percentage of unpermitted operations which have them (33 percent).

Absence of an impoundment indicates little effort has been made to contain runoff at all, much less meet BPT or BAT. Aside from individual follow up of each permittee, the only stimulus for construction of impoundments would have been a series of complaints or chance observations made by enforcement personnel at the time discharges occurred. For the reasons discussed earlier, complaints are often not generated; and as discharges are often brief and intermittant, they may not be witnessed by enforcement personnel. Thus, a discharging operation often is not recorded as a problem.

Permitted operations identified in the Caldwell aerial survey showed an interesting divergence between dairies and feedlots, although the number of feedlots and dairies is too small for a good statistical sample. Overall, a much larger percentage of previously permitted dairies and poultry operations (50 percent) tended to have impoundments than feedlots (28 percent). It is unknown whether this is because dairy farmers are more waste conscious; because the SCS in this area offers assistance to dairies but not to feedlots, which are considered to be commercial operations (Zollinger pers. comm.); because dairies have a year-round discharge, which makes impoundments more desirable; because the Health Department has worked with the dairies; or whether a combination of factors is involved. It is likely, however, that SCS involvement in dairies has played a strong role in construction of impoundments in this area. Their involvement in feedlots has played an important role in other areas such as Colorado (Love pers. comm.) and could be of benefit in the Caldwell area should their role be expanded to include at least the smaller feedlot operations.

A high percentage of dairies (50 percent) do not restrict access to water. This is one BMP that appears to have limited emphasis. The use of BMPs and the content of facilities plans are discussed in Chapter 4.

Twin Falls Area (Glenns Ferry to American Falls)

Although the Twin Falls area contains only about 30 percent of the previously permitted operations, it has by far the largest concentration of operations (primarily dairies) in the state.

Table 2-6. Relationship Between Permits, Impoundments, and Complaints in the Caldwell Area

	PREVIOUSLY PERMITTED	SURVEYED		SURVEYED & PERMITTED		SURVEYED & UNPERMITTED		SURVEYED & PERMITTED, WITH COMPLAINT		TOTAL COMPLAINTS (1977-1984)	
		PERM.	NONPERM.	IMPOUND.	NO IMPOUND.	IMPOUND.	NO IMPOUND.	IMPOUND.	NO IMPOUND.	PERM.	NONPERM.
Beef Feedlot	30	20	5	6	14	1	4	3	3	10	15
Dairy/ Poultry	7	5	1	2	3	1	0	1	0	2	26
TOTAL	37	25	6	8	17	2	4	4	3	12	41

SOURCES: EPA permit files; EPA 1984a; IDHW files.

The survey methodology for this area was different from that of other areas. Because the IDHW regional office hoped to quantify the problem and identify the areas of greatest density, the survey provided blanket coverage of much of the area. In contrast, the other surveys focused on areas of known problems or dairy and feedlot concentrations. All other things being equal, blanket coverage will result in a much larger number of operations being identified. However, there is also a much higher density of dairies per unit area in the Twin Falls area.

There are also more new (post-1974) sources in the Twin Falls region than in other areas, and they are primarily dairies. As discussed previously, many of these are located in the fast-growing Magic Valley area.

Sources Identified Through Permits and Aerial Photo Survey. The Twin Falls area contains 16 previously permitted feedlots and four previously permitted dairies, as shown in Table 2-7. The total number and feedlot/dairy ratio of previously permitted operations provides a false impression. By far the greatest number of operations are dairies and the total number far exceeds that of other study areas. IDHW personnel estimate approximately 2,000 dairies and feedlots in the area (McMasters pers. comm.). Because the NPDES regulations generally required permits only for facilities of >200 dairy cattle, most of the dairies were too small to be permitted. The great majority of dairies are <200 animals.

Although few permitted sources exist, the aerial survey identified 200 sources, nearly seven times the number identified in the Caldwell and Blackfoot areas. Seven (possibley eight) of the 20 permitted operations were covered by the aerial survey. Table 2-8 summarizes results of the aerial survey, gives locations and receiving water segments, and indicates which operations were previously permitted.

Only 41 feedlots and dairies having over 200 animals were identified in the Twin Falls survey. Only two feedlots and one dairy contained over 1,000 animals. As with the Caldwell area, however, care should be taken not to overemphasize the importance of numbers obtained in the aerial survey. Many factors contribute to produce variations (normally underestimates) of actual animal numbers, and many factors other than the number of animals will play a role in water quality impact. Groundtruthing surveys indicate many of the animals may have been on BLM range at the time of the survey (April). This contributed to underestimations of both the number of animals and feedlot operations.

There is a high density of dairies throughout much of the Twin Falls area, but the highest concentrations north of the Snake River (as identified in the survey) are located in the vicinity of Wendell, Jerome, Gooding, Richfield, Shoshone, and Hagerman, with scattered operations in Tuttle, Fuller, Rupert, and other areas. South of the Snake River, the area of highest

Table 2-7. Previously Permitted Operations in the Twin Falls Area[a]

PERMIT NUMBER	EXPIRATION DATE	NAME[a]	AREA	RECEIVING WATER	RECORDED COMPLAINTS
			PERMITTED FEEDLOTS		
002210-1	6/7/79	Albert Anderson & Sons	Oakley	Snake R (via Goose Cr)	
002313-2	6/6/79	Blincoe Farms, Inc.	Paul	Snake R	
002160-1	6/4/79	Burley Butte Custom Feedlot	Burley	Snake R	
002164-4	6/11/79	Circle 4 Cattle Co.	Jerome	Snake R	
002161-0	6/6/79	D. M. Ranches, Inc. (Cattle)	Paul	Snake R	
002241-1	6/4/79	D. M. Ranches, Inc. (Sheep) (Darryl Manning)	Paul	Snake R	
002230-6	6/11/79	France, Inc. (Triangle Feedlot)	Gooding	Big Wood R	
002234-9	6/11/79	Hill Inc.	Shoshone	Big Wood R	
002113-0	6/4/79	Interstate Feeders, Inc.	Malta	Snake R (via Raft R)	
002288-8	6/7/79	Jones Livestock Feed Co., Inc.	Eden	Snake R (via Goose Lk)	
002232-2	6/11/79	Lynn Manning & Sons	Paul	Snake R (via Main Drain)	
002224-1	5/28/79	Olmstead Cattle Co.	Twin Falls	Snake R (via Rock Cr)	
002296-9	6/6/79	Robert Schenk	Paul	Snake R (via unnamed canal)	
002190-3	6/4/79	Russel G. Linstrom	Paul	Snake R (via unnamed canal)	
002481-3	8/31/82	Toone Ranches	Buhl	Unnamed canal	*
002280-2	6/11/79	Uhlig Feedlots, Inc.	Hansen	Snake R (via Main Canal)	
			PERMITTED DAIRIES		
002470-8	6/2/82	K. V. Dairy, Inc.[b]	Hagerman	Snake R	*
002483-0	8/31/82	Shady Grove Dairies, Inc.	Hagerman	Billingsley Cr	*
002469-4	6/2/83	Stoker Dairy	Burley	Snake R	*
002220-9	10/31/79	Simplot Industries (C & Y Farms)	Malta	Raft R	

---

* Identified in Volume 3 or 4 of the aerial survey (EPA 1984c, 1985).

[a] Names in parentheses indicate previous name or other identifying name under which information exists in IDHW files.

[b] This dairy not included on EPA permit listing because of wrong computer entry code.

SOURCES: EPA and IDHW Files.

Table 2-8. Confined Animal Feeding Operations Identified by Aerial Survey in the Twin Falls Area

FEEDLOTS/STOCKYARDS

SITE NO.	NAME[a]	FEEDING AREA (AC)	NO. ANIMALS[b]	RECEIVING WATER[c]	ANIMAL ACCESS/ PEN DISTANCE TO WATERWAY (FT)	SLOPE[d]	IMPOUNDMENTS (#, ACRES)	GENERAL LOCATION
99	Mink	3.5	51-200	USB 850	Direct access	F	None	Gooding
100	C. Adams	2.0	51-200	USB 850	Direct access	M	None	Gooding
114	J. Patterson	0.75	51-200	USB 850	?	F	None	Gooding
115	J. Patterson	13.0	>1,000	USB 850	40	F	2; 2 AC	Gooding
116	Arkoosh & Zidan	10.0	51-200	USB 850	50	F	None	Gooding
120	Wiseman	7.0	51-200	None	1,000	F	None	Gooding
121	Gooding Stockyards	14.0	<50	USB 850	30	S	None	Gooding
127	W. Fields	10.0	51-200	None	20	F	None	Tuttle
132	E. Morris	5.0	201-700	Canal	Direct access	F	None	Hagerman
139	Ray Gardner	2.0	<50	USB 80	Direct access	F	None	Hagerman
142	C. Edwards	2.5	51-200	Curren Dit	285	M	None	Hagerman
143	Ernie Hegie+	9.0	--	None	4,200	M	None	Hagarman
156	Roy Vader	5.5	51-200	None	85	F	None	Hagerman
157	E. Radermacher	5.0	51-200	None	Direct access	F	None	Shoshone
166	Richard Bateman	0.5	51-200	USB 80	Direct access	F	None	Shoshone
167	Tina Iest	8.0	51-200	USB 871	Direct access	F	None	Shoshone
168	Pete Oneida	2.0	51-200	USB 850	Direct access	F	None	Shoshone
171	Jose Arrate	12.0	51-200	USB 850	270	M	None	Shoshone
174	Dale Low (Stockyard)	3.5	51-200	None	420	F	None	Shoshone
202	Howard Harder	1.0	<50	USB 80[g]	Direct access	F	None	Buhl
206	Leo Meyers	1.8	51-200	USB 80[g]	Direct access	F	None	Buhl
211	M. Guerry	17.0	51-200	USB 820	760	S	None	Buhl
229	Circle M Ranch	8.9	201-700	Lateral	50	F	None	Wendell
230	France Cattle Co. *	110.5	>1,000	None	40	F	7; 8.1 AC	Wendell
235	Larry Holtzen Cattle Co.	11.0	51-200	None	40	F	None	Jerome
253	R. Chugg Livestock	25.0	201-700	None	2,000	M	None	Jerome
254	G. C. Gould (Glendale Ranch)	5.7	51-200	None	Direct access	F	None	Buhl
256	A. S. Vickers	2.9	51-200	USB 730	440	F	None	Twin Falls
264	D. R. Cambell	7.3	201-700	Lateral?	255	M	None	Kimberley
265	E. Barnes	56.6	>1,000	T F Main C	2,050	F/M	1; 1.2 AC	Hansen
266	Uhlig Ranches*	26.9	701-1,000	T F Main C	80	F	2; 1.1 AC	Hansen
267	Butte Farms *(?)	7.5	201-700	Lateral?	5,540	M	None	Hazelton
270	Blincoe Farms Inc.*	36.5	--	B-4 Canal	40	M	2; 1.3 AC	Paul
271	R. Lindstrom*	25.3	201-700	B-4 Canal	40	F	None	Paul
272	R.L. Bryant & W.A. Eager	24.3	51-200	USB 60B	80	F/M	2; 0.3 AC	Burley
273	Moorman Ranches	17.5	--	USB 60B[f]	Direct access	M/S	None	Burley
275	J. Chisholm	45.0	--	None	20	F	None	Acequia
277	Sheep Sheo Ranches	83.9	--	USB 60A	40	F	None	Rupert
278	Oxrango	54.0	--	None	40	F	None	Rupert
279	R. Robbins	13.2	--	None	40	F	None	Rupert
281	F. Jouglard	43.8	--	None	10	F	None	Rupert
283	J. Ituarte	27.0	51-200	USB 60A	10	M	None	Rupert
289	Taylor Land Co.	24.0	--	USB 520	585	M	None	Raft River

Table 2-8. Continued

FEEDLOTS/STOCKYARDS

SITE NO.	NAME[a]	FEEDING AREA (AC)	NO. ANIMALS[b]	RECEIVING WATER[c]	ANIMAL ACCESS/ PEN DISTANCE TO WATERWAY (FT)	SLOPE[d]	IMPOUNDMENTS (#, ACRES)	GENERAL LOCATION
290	Taylor Land Co.	10.4	--	USB 520(?)	585	F	None	Raft River
291	Howard Conrad	61.3	701-1,000	None(?)	3,165	M	1; 2.1 AC	Burley
292	V. T. Geary	2.7	701-1,000	J Canal	Direct access	F	None	Burley

DAIRIES

SITE NO.	NAME[a]	FEEDING AREA (AC)	NO. ANIMALS[b]	RECEIVING WATER[c]	ANIMAL ACCESS/ PEN DISTANCE TO WATERWAY (FT)	SLOPE[d]	IMPOUNDMENTS (#, ACRES)	GENERAL LOCATION
101	N. W. Rasmussen	1.5	51-200	USB 850	Direct access	F	None	Shoshone
102	A. Kerner	4.0	51-200	USB 850	Direct access	S	1; 0.3 AC	Richfield
103	G. Kerner	5.5	51-200	USB 850	Direct access	S	None	Richfield
104	Idaho Dairy Farm	7.0	51-200	USB 871[e]	40	M	2; 1.5 AC	Richfield
105	Lee Roy Parker	3.0	51-200	USB 871[e]	Direct access	M	None	Richfield
106	Ralph Riley	1.75	51-200	USB 871[e]	?	M	None	Richfield
107	R. W. Johnson	5.5	<50	USB 871	Direct access	F	2; 0.75 AC	Richfield
108	R. W. Johnson	1.5	<50	USB 871	280	F	None	Richfield
109	Cid Lesamiz+	5.0	51-200	USB 871	1,370	F	None	Richfield
110	James Powell	3.0	51-200	USB 871	Direct access	M	None	Richfield
111	Blaine Sorenson	8.0	51-200	USB 871	Direct access	F	None	Richfield
112	Rod Pridmore	3.0	51-200	USB 871	30	F	None	Richfield
113	A. R. Sumner	2.5	51-200	Canal	Direct access	F	None	Gooding
117	W. Boeslger	1.5	51-200	USB 850	Direct access	F	None	Gooding
118	A. C. Sabala	5.0	51-200	USB 850	40	F	2; 0.25 AC	Gooding
119	M. Sabala	1.0	<50	None	1,000	F	None	Gooding
122	T. Bingham	3.5	51-200	Pond	3,500	M	None	Gooding
123	R. C. Zaplicke	10.0	201-700	USB 871	190	F	None	Gooding
124	O. Leavell	24.0	51-200	None	1,850	F	2; 0.25 AC	Fuller
125	L. Graves	3.0	<50	None	800	F	None	Tuttle
126	Faulkner Land & Livestock	35.0	<50	None	10	F	None	Tuttle
128	R. Bingham	4.0	51-200	None	2,500	F	None	Gooding
129	B. Noringer	7.5	51-200	None	50	F	2; 0.5 AC	Gooding
130	F. Graves & Sons	2.5	51-200	None	1,200	F	None	Tuttle
131	G. Hooper	5.0	51-200	Canal	Direct access	F	None	Tuttle
133	Firmage Co.	10.0	51-200	Big Bend D	Direct access	F	None	Hagerman
134	G. Coleman	10.0	51-200	USB 840	Direct access	M	None	Hagerman
135	A. Schilling	2.5	51-200	None	30	F	None	Wendell
136	A. Schilling	0.5	<50	Canal	Direct access	F	None	Wendell
137	B. Hilardes	4.0	51-200	Canal	Direct access	M	None	Wendell
138	B. Hilardes	11.5	201-700	None	Direct access	M	None	Wendell
140	Buckeye Ranch	11.0	None	USB 80	40	F	None	Hagerman
141	V. I. Maveneamt	1.75	<50	Curren Dit	?	M	None	Hagerman
144	R. McCord	4.5	51-200	None	1,000	F	None	Wendell

Table 2-8. Continued

SITE NO.	NAME[a]	FEEDING AREA (AC)	NO. ANIMALS[b]	RECEIVING WATER[c]	ANIMAL ACCESS/ PEN DISTANCE TO WATERWAY (FT)	SLOPE[d]	IMPOUNDMENTS (#, ACRES)	GENERAL LOCATION
145	Vandenburg Bros.	4.0	<50	Canal	Direct access	F	1; 0.25 AC	Wendell
146	Hill Brandsma+	3.0	51-200	Canal	40	F	2; 0.25 AC	Wendell
147	S. Goodhart	4.0	51-200	Canal	40	F	2; 0.25 AC	Wendell
146	E. Ciocca	10.0	201-700	Canal	1,450	F	1; 0.3 AC	Wendell
149	R. Mathers	4.5	51-200	Canal	200	F	None	Wendell
150	K. Tincate	7.5	51-200	Canal	200	M	None	Wendell
151	Jensen & McIntyre	10.0	<50	Canal	Direct access	M	None	Wendell
152	H. Twamley	8.0	51-200	None	660	F	None	Wendell
153	G. Bird	.5	<50	Canal	Direct access	M	None	Wendell
154	B. Andrews	1.0	51-200	None	40	F	None	Wendell
155	J. Kening	2.5	51-200	None	40	F	None	Wendell
158	B. Rictkirk	6.0	51-200	None	1,330	F	None	Wendell
159	H. Rictkirk	18.0	51-200	None	40	M	None	Wendell
160	L. Loper	6.5	51-200	None	1,125	F	None	Wendell
161	R. Van Dyke	5.0	51-200	Canal	Direct access	S	None	Wendell
162	R. Van Dyke	3.5	51-200	Canal	Direct access	M	None	Wendell
163	R. Van Dyke	23.0	201-700	Canal	830	M	None	Wendell
164	R. Neales	5.5	201-700	Canal	40	F	None	Wendell
165	Shoemaker Bros.	4.0	51-200	Canal	85	M	None	Wendell
169	William Harris	None	<50	USB 850	Direct access	M	None	Shoshone
170	Jose Arrate	1.5	<50	USB 850	Direct access	F	None	Shoshone
172	Farnsworth/Koeppen (2 dairies)	4.0	51-200	USB 850	Direct access	M	None	Shoshone
173	Alex Anchustegui	0.5	<50	USB 850	Direct access	M	None	Shoshone
175	W. Patterson	9.5	51-200	J Canal	1,100	M	None	Jerome
176	W. Patterson	4.5	51-200	None	150	F	None	Jerome
177	E. Thompson	12.0	<50	Lateral(?)	Direct access	M	None	Wendell
178	Ed. Hubbard	10.0	201-700	None	900	F	4; 6.0 AC	Wendell
179	Fox Canyon Livestock	26.0	201-700	Lateral(?)	80	F	1; 0.1 AC	Wendell
180	Pete Veenstra	10.0	51-200	Lateral(?)	20	M	2; 1.5 AC	Wendell
181	J. Dufree	3.0	51-200	None	310	F	None	Wendell
182	Dew Dufree	3.75	51-200	None	1,865	F	None	Wendell
183	E. A. Branch	10.0	51-200	None	Direct access	F	None	Wendell
184	W. Kearley	1.0	51-200	None	660	F	None	Wendell
185	R. Crosby	10.0	51-200	Lateral	125	M	None	Wendell
186	Harry Goedhart+	17.4	201-700	USB 740	325	F/M	2; 2.1 AC	Wendell
187	Flamingo Dairy	3.5	51-200	USB 70	350	F	None	Wendell
188	Jim Pearson	1.8	51-200	USB 810(?)	40	F	None	Buhl
189	T. Sertek	1.1	<50	USB 810(?)	Direct access	F	None	Buhl
190	Tom Pearson	1.5	51-200	USB 810	940	F	1; 0.25 AC	Buhl
191	Merle Engi	5.5	<50	USB 810	1,760	F	None	Buhl
192	Mike Vierstra	3.6	51-200	USB 809	600	F	1; 1.5 AC	Buhl
193	Leonard Easterday	7.8	51-200	USB 820	Direct access	F	None	Buhl
194	A. Barker	3.7	51-200	None	Direct access	F	None	Buhl
195	Howard Harder	11.1	51-200	None	Direct access	F	3; 0.9 AC	Buhl
196	Harry Bokma+	6.9	201-700	USB 820	40	F	2; 0.03 AC	Buhl
197	Harry Hoagland	15.0	51-200	USB 810	40	F	2; 2.7 AC	Buhl
198	Manuel Sausa Dairy+	1.5	51-200	USB 810	40	F	None	Buhl
199	Fred Kippas	1.0	51-200	USB 810(?)	300	F	None	Buhl
200	Mike Donahue+	4.4	51-200	USB 810(?)	55	F	2; 0.8 AC	Buhl

Table 2-8. Continued

SITE NO.	NAME[a]	FEEDING AREA (AC)	NO. ANIMALS[b]	RECEIVING WATER[c]	ANIMAL ACCESS/ PEN DISTANCE TO WATERWAY (FT)	SLOPE[d]	IMPOUNDMENTS (#, ACRES)	GENERAL LOCATION
201	Bob Visser	1.2	<50	Low Line C	645	F	None	Buhl
203	D. Acgenback	3.4	51-200	USB 809[g](?)	Direct access	F	None	Buhl
204	Toone (Lone Tree)+* (abandoned)	2.8	--	USB 809[g](?)	235	F	2; 0.5 AC	Buhl
205	Curtis Brenden Dairy	10.0	201-700	USB 809[g]	1,935	M	1; 0.9 AC	Buhl
207	Ken Lowman	3.0	<50	Low Line C	40	F	2; 1.8 AC	Buhl
208	John DeKruyf+	4.5	51-200	USB 809[g](?)	10	F	1; 1.8 AC	Buhl
209	W. Shaffer	6.3	51-200	Low Line C	920	F	None	Buhl
210	FHA Dairy (abandoned)	2.0	51-200	None	85	F	None	Buhl
212	Wells Livestock	32.7	--	USB 820	20	M	None	Buhl
213	Rick Lowman	2.8	201-700	None	425	F	2; 2.8 AC	Buhl
214	J. W. Hoogland	5.8	51-200	None	85	F	None	Buhl
215	John Schildner	9.1	51-200	USB 810	65	F	1; 0.2 AC	Buhl
216	W. J. Lammer	5.5	51-200	USB 810	20	F	None	Buhl
217	Don Bothof+	7.4	51-200	USB 810	65	F/M	2; 0.9 AC	Buhl
218	W. K. Wert	6.0	51-200	None	310	F	1; 3.5 AC	Buhl
219	B. and Z. Harrison	3.0	<50	USB 740	Direct access	F	None	Wendell
220	G. Arkoosh & Zidan	10.0	51-200	None	40	F	None	Wendell
221	Kober Farms	4.0	51-200	None	230	F	1; 1.0 AC	Wendell
222	Kober Farms	3.5	51-200	None	40	F	None	Wendell
223	Howard Meyers	18.7	201-700	None?	140	F	None	Wendell
224	L. Jones	9.3	201-700	None	1,460	S	1; 0.3 AC	Jerome
225	P. Holloway	14.0	201-700	Lateral?	Direct access	F	None	Jerome
226	B. Vander Meer	11.5	201-700	Lateral?	80	M	2; 1.5 AC	Jerome
227	D. Leerman	18.5	701-1,000	Lateral?	80	M	2; 0.8 AC	Jerome
228	Mike Vierstra	11.0	201-700	None	145	M	3; 3.0 AC	Wendell
231	Standing Hat Ranch	4.3	51-200	None	2,520	F	None	Wendell
232	Ted Miller	15.4	201-700	Lateral	650	F	3; 3.5 AC	Wendell
233	Muddler Cattle Co.	10.8	51-200	None	80	F	1; 1.0 AC	Jerome
234	W. McCaughey	2.0	51-200	None	1,300	F	None	Jerome
236	M. Bishop	2.7	51-200	None	675	F	None	Jerome
237	Calvin DeKruyf	13.2	201-700	Lateral	60	F	1; 3.5 AC	Jerome
238	Gary Bothof	7.3	51-200	Lateral	325	F	1; 1.2 AC	Jerome
239	Ted Baar (Double Dipper Dairy)+	16.5	201-700	Lateral	80	F	7; 2.8 AC	Jerome
240	L. Andressen	12.5	201-700	None	40	F	3; 1.5 AC	Jerome
241	A. Reliance	16.0	201-700	None	880	F	3; 4.0 AC	Jerome
242	H. Van Beck	16.0	201-700	None	320	F	None	Jerome
243	J. Jackson	4.7	51-200	None	60	F	None	Jerome
244	H. Vander Meer	15.9	201-700	Lateral?	640	F/M	2; 1.0 AC	Jerome
245	Bob Morris	5.0	51-200	L Canal	40	F/M	None	Jerome
246	Irene Vander Vegt+(?)	13.9	51-200	Lateral	Direct access	F	3; 2.25 AC	Jerome
247	Marion Vanden Bosch	4.7	<50	Lateral	Direct access	F	None	Jerome
248	Reisman	4.5	201-700	Lateral?	520	F/M	None	Jerome
249	J. Tolman	3.4	51-200	Lateral?	Direct access	F	1; 0.5 AC	Jerome
250	Drew Critzer	5.9	201-700	D-5 Ditch	855	F	2; 1.8 AC	Jerome
251	V. Bishop	4.5	51-200	USB 740	Direct access	M	None	Buhl
252	Larry Vander Vegt +(?)	17.0	51-200	Lateral?	Direct access	F	1; 2.3 AC	Jerome
255	Frank Dores (abandoned)	3.2	51-200	Lateral?	Direct access	F	1; 0.6 AC	Buhl
257	A. Drolaw	5.8	51-200	Lateral	850	F	None	Filer
258	Robert and Dale Sandigar	6.8	51-200	USB 740[f]	20	F	2; 0.5 AC	Filer

Table 2-8. Continued

SITE NO.	NAME[a]	FEEDING AREA (AC)	NO. ANIMALS[b]	RECEIVING WATER[c]	ANIMAL ACCESS/ PEN DISTANCE TO WATERWAY (FT)	SLOPE[d]	IMPOUNDMENTS (#, ACRES)	GENERAL LOCATION
259	Stan Nunes Dairy	8.0	51-200	USB 740[f]	Direct access	M	None	Filer
260	J. Hoogland (formerly Alneida)	5.8	51-200	Low Line C	Direct access	F	3; 2.1 AC	Filer
261	Clyde Wright	3.3	51-200	Low Line C	Direct access	F	None	Filer
262	Classic Dairy (Bud Vierstra)+(?)	10.8	201-700	USB 730[f]	40	F	2; 3.0 AC	Twin Falls
263	Rosco Wagner	3.0	<50	USB 730	85	S	None	Twin Falls
268	G. Stoker +(?)	13.5	--	None	20	M/S	None	Rupert
269	Darryl Manning*	14.8	201-700	None	40	F	None	Paul
274	K. and J. Hayden	4.5	51-200	None	30	F	None	Acequia
276	Walcott Ranches	5.2	51-200	Lateral?	40	M	None	Acequia
280	Ivan Haskel	8.4	51-200	Main S C	Direct access	M	None	Rupert
282	Barbara Studer	5.1	51-200	A Canal	20	F	None	Rupert
284	E. Lind	5.2	201-700	Main S C	Direct access	F	3; 0.4 AC	Declo
285	A. Brim	3.6	51-200	None	165	F	1; 0.2 AC	Raft River
286	L. Funk (Riviera Farms, Inc.)	5.5	51-200	USB 520	160	S	None	Raft River
287	C. H. Hisaw	1.9	51-200	None	180	F	1; 0.4 AC	Raft River
288	Simplot Industries*	26.0	>1,000	Lateral?	Direct access	F/M	3; 4.0 AC	Raft River
293	R. Garrett+	5.2	51-200	Snipe Gul	20	F	3; 3.0 AC	Burley
294	S. Alred	1.0	51-200	None	Direct access	F	None	Burley
295	R. D. Zollinger	4.5	51-200	USB 60A[h]	Direct access	M	1; 0.1 AC	Burley
296	C. Williams	12.3	51-200	None	450	F	None	Burley
297	M. Payne	4.9	51-200	H Canal	1,300	F	1; 0.1 AC	Burley
298	F. Robinson	7.8	51-200	H Canal	20	F	None	Burley

---

[a] * = Permitted; + = Water quality complaint received by IDHW.
[b] It should be noted that number of animals may vary substantially depending on time of year.
[c] USB 80 - Snake R (Buhl - King Hill)
USB 810 - Deep Cr (Source - mouth)
USB 820 - Salmon Falls Cr (ID/NV border - mouth)
USB 840 - Billingsley Cr (Source - mouth)
USB 850 - Big Wood R (Source - Magic Res)
USB 871 - Little Wood R (Source - Richfield)
USB 70 - Snake R (Milner Dam - Buhl)
USB 730 - Rock Cr (City - mouth)
USB 740 - Cedar Draw Cr (Source - mouth)
USB 60A - Snake R (Minidoka Dam - Heyburn/Burley Bridge)
USB 60B - Snake R (Heyburn/Burley Bridge - Milner Dam)
USB 520 - Raft R (Source - mouth)
[d] F = Flat; M = Moderate (5-10 percent); S = Steep (>10 percent)
[e] Via Jim Burns Slough
[f] Via lateral
[g] Via Mud Cr
[h] Via Duck Cr

SOURCES: EPA 1984b; EPA 1985; Morrison pers. comm.

concentration appears to be Buhl. It should be emphasized, however, that these numbers include only operations identified in the aerial survey and probably greatly underestimate total operations. Some concentration areas were also missed entirely.

Flight lines for the survey were determined by IDHW, and screening criteria were applied during interpretation that limited interpretation to feedlots >50 head or 10 acres and dairies >25 head or 3 acres unless animals were allowed direct access to water (Becker pers. comm.). The IDHW has identified 74 additional operations from photos in the EPA Volume 3 report that were overlooked or not identified in the survey for various reasons. Some operations were too small, and were screened out during interpretation. IDHW estimates 40-45 percent of those not identified in the photos were omitted because they did not pass the screening criteria (Morrison pers. comm.). Other operations were located so close together that two operations were identified as one. Still others had cows on pasture at this time and were therefore not identified as feedlots during interpretation.

In addition to the deletions and omissions, several important areas were omitted entirely in the aerial survey coverage. One of the most obvious was Jerome County. Of the approximately 130 dairies in Jerome, only 3-5 were noted in the survey. Two notable operations missed in the Jerome area include a 9000 head feedlot and a 2000 head dairy (Morrison pers. comm.). Four areas containing numerous dairies missed by the aerial survey include: 1) areas having absence of lava rock directly to the south of Wendell, 2) two areas due east of Shoshone, and 3) an area northeast of Richfield (Morrison, Allred, Davidson pers. comm.). Because so many operations were screened out or missed by the survey, IDHW and health department personnel indicate that the numbers in the survey should be considered as estimates representing from 50 to as low as 10 percent of the actual number of total operations present.

Approximately 27 and 31 percent of feedlots and dairies, respectively, appear to allow animals direct access to water. In contrast to the other study areas, however, a large number of these operations access canals and laterals rather than streams or rivers. In such a situation, although direct waste placement is possible, sedimentation caused by trampling may be somewhat reduced. Eighty-four and 64 percent of feedlots and dairies, respectively, show no evidence of impoundments.

Sources Identified Through Complaints. The IDHW field office in Twin Falls was the primary source of complaint information. The local health departments also provided complaint information, although most of their complaints were related to odor and flies. Nearly 80 water quality-related complaints for dairies and feedlots were received by the Twin Falls IDHW field office from 1976 to December 1984. These are summarized in Table 2-9. For the many reasons discussed previously in the Caldwell section, this is certainly a great

Table 2-9. Summary of Complaints Received for Confined Animal Operations in the Twin Falls Area (1976-1984)

COMPLAINTS FOR FACILITIES IDENTIFIED BY SURVEY OR PERMIT		COMPLAINTS FOR ADDITIONAL FACILITIES	
FEEDLOT	DAIRY	FEEDLOT	DAIRY
1	18	5	69

SOURCE: IDHW files.

underestimate of actual discharges, although the data indicate an increasing number of complaints over time, particularly since 1980. This can be attributed to increased precipitation, rising public awareness, and to some extent, an increased number of operations.

Complaints received have been primarily for dairies, with the exception of five feedlot complaints and three beaver farm and hog raising operation complaints in 1981. Only four permitted operations received a complaint. Three of the four were dairies. A number of other unpermitted dairies identified in the aerial survey received complaints. Fifteen of the dairy operations received complaints in at least two different years, and some appear to be chronic dischargers.

The great majority of the complaints relate to non-identified operations, i.e., those neither previously permitted nor identified in the photo survey. Although the majority of these dairies contain <200 cattle, cumulatively they have a heavy impact on surface waters and canals. These dischargers can and should be re-investigated and included in the permit when applicable.

Contact was made with the IDHW personnel to determine status of the operations where possible. Table 2-10 lists some of the non-identified farms in the Twin Falls area potentially requiring permits.

Status of Previously Permitted Operations. Table 2-11 summarizes the relationship between permits, impoundments, and complaints for the Twin Falls area. It can be seen from the table that only 31 percent of the total operations surveyed have impoundments of any kind. Feedlots lag behind dairies; only 16 percent of the feedlots (compared to 36 percent of the dairies) have constructed holding facilities. The previous work of the SCS in design of dairy facilities is probably one major reason for this difference. Of the permitted operations surveyed in the Twin Falls area, five of the eight (62%) had impoundments and three (38%) did not.

It should not automatically be assumed that presence of an impoundment indicates correct sizing or compliance with BPT or BAT. It is not possible to determine correct sizing from aerial photos alone because volume of the impoundment, not just surface area, determines capacity. As noted earlier also, the primary deterrent to a discharge is not size but maintenance. If there is no regular pumping of an impoundment, discharges will eventually occur.

Blackfoot Area (American Falls to Sugar City)

Although the Blackfoot area contains only about 15 percent of the permitted feedlots and dairies, survey methodology allowed identification of a large number of medium-sized operations. Survey methodology for Blackfoot was somewhat a mixture of that

Table 2-10. Additional Dairies and Feedlots Potentially Requiring Permits in the Twin Falls Area[a]

NAME	LAST KNOWN APPROXIMATE SIZE	LOCATION	TYPE
Ralph Olmstead	2-700	Twin Falls	Dairy
Aurora Capital Dairy	1500	Hazelton	Dairy/Feedlot
Henry Jones	2000-7000	Hazelson	Feedlot
Ralph Nipper	100	Buhl	Dairy
Doug Benson	500	Gooding Co.	Dairy
Cecil Hilt	300	Gooding Co.	Dairy
C. Edwards	4-700	Hagerman	Feedlot
John Bucher	500	Wendell	Dairy
John Koning	200	Wendell	Dairy
Jack Nelson	200	Jerome	Dairy

---

[a] As established from complaint files and discussions with state personnel. These facilities are in addition to those previously permitted or identified by aerial survey. This should not be considered a complete list.

Table 2-11. Relationship Between Permits, Impoundments, and Complaints in the Twin Falls Area

	PREVIOUSLY PERMITTED	SURVEYED		SURVEYED & PERMITTED		SURVEYED & UNPERMITTED		SURVEYED & PERMITTED, WITH COMPLAINT		TOTAL COMPLAINTS (1977-1984)	
		PERM.	NONPERM.	IMPOUND.	NO IMPOUND.	IMPOUND.	NO IMPOUND.	IMPOUND.	NO IMPOUND.	PERM.	NONPERM.
Beef Feedlot/ Stockyard	16	5	41	3	2	4	37	-	-	-	5
Dairy	4	3	15	2	1	54	97	1	-	3	84
TOTAL	20	8	192	5	3	58	134	1	-	3	89

SOURCES: EPA permit files; EPA 1984c; EPA 1985; IDHW files.

used in the Twin Falls and Caldwell areas; a number of known concentration areas were flown rather than attempting coverage of the entire area, but emphasis was placed on entire areas rather than individual known operations. This methodology resulted in identification of a much larger number of small dairies than in the Caldwell area.

Discussions with IDHW, district health department, and SCS personnel indicate dairies are the main problem in the Blackfoot region. Feedlots are less numerous and generally small. A few are found on the Snake and Rainbow Rivers; all are older sources. Most dairies are also existing (pre-1974) sources. The area of greatest concentration occurs in Franklin County. The main water quality problem areas are Mink and Worm Creeks, tributaries to the Bear River and the Cub River (Hopson pers. comm.). Marsh Creek is another area where agricultural sources are a great problem, but the problem is sediment, not animal confinements (Curtis pers. comm.). IDHW estimates perhaps 50 dairies and 10 feedlots in this area, with only three having likelihood of affecting surface water (Hopson pers. comm.).

Approximately 30 operations have facility plans filed with the IDHW office. Many plans were developed in the mid to late 1970s; there is nothing recent. Other priorities have resulted in IDHW relying more on SCS for plan development, but IDHW recognizes that this does not appear to be working well.

SCS provides help to feedlots as well as dairies in this area. Facilities for previously permitted operations were normally designed to contain runoff from a 2-inch rainfall, although occasionally they were designed for 1.5 inches. The SCS in this area uses actual runoff or generally assumes a 1-inch runoff, whichever is greater, and designs for a 10-year storm with a recommended minimum 90-day holding capacity (Curtis pers. comm.).

Sources Identified Through Permits and Aerial Survey. Ten feedlots were previously permitted for the Blackfoot area (Table 2-12). No dairies were permitted. Only seven of the ten permitted operations were identified in the aerial survey. Although very few of the operations were identified in the survey, it is known that the remaining three previously permitted operations are not within the survey area (Hopson pers. comm.). If the same ratio holds true for unpermitted operations, probably at least 30 percent of the existing operations were not covered by the survey. As in the case of Twin Falls, a number of dairies actually on the photos of the survey area were screened out or not identified for various reasons.

Although all of the larger operations (700 animals or more) were identified, animal numbers within a facility may fluctuate greatly over time. Feeding-area size, drainage, and other factors may be a better (or at least equally valid) method of determining potential impacts or screening for potential permit holders.

Table 2-12. Previously Permitted Operations in the Blackfoot Area

PERMITTED FEEDLOTS

PERMIT NUMBER	EXPIRATION DATE	NAME[a]	AREA	RECEIVING WATER	RECORDED COMPLAINTS
002298-5	6/13/79	Arnold Feedlot	Idaho Falls	Snake R (via Sand Cr)	
002187-3	6/4/79	*Clement Brothers Livestock (Lyle Taylor)	Menan	Snake R	
002291-8	6/13/79	Hyer Cattle Co.	Shelley	Snake R	
002227-6	6/11/79	*Harris-Idaho, Inc. (Harding Livestock & Land)	Blackfoot	Snake R	
002186-5	5/28/79	Lenard A. Schritter Feedlot	Aberdeen	Snake R	
002226-8	6/4/79	*Louis Skaar and Sons, Inc.	Roberts	Snake R	
002117-2	6/4/79	*Meyers Brothers Feedlots, Inc.	Sugar City	N Fork Teton R	
002140-7	5/28/79	*Sand Ridge Feeding Co.	Blackfoot	Blackfoot R	
002171-7	5/28/79	*Snake River Cattle Co., Inc.	American Falls	Snake R	
002221-7	6/4/79	*Spur Cattle Co.	Roberts	Snake R	

PERMITTED DAIRIES

- 0 -

---

* Identified in Volume 2 of the aerial survey (EPA 1984b).

[a] Names in parentheses indicate previous name or other identifying name under which information exists in IDWH files.

SOURCES: EPA and IDHW files.

Table 2-13 summarizes results of the aerial survey, gives facility locations and receiving water segments, and indicates which operations were previously permitted.

Although few permitted sources exist, the aerial survey identified 67 sources, nearly twice the number of operations identified in the Caldwell area but only approximately one-third of those in the Twin Falls region. Also, in contrast to the Caldwell or Twin Falls areas, where the great majority of the surveyed operations were either feedlots or dairies, equal numbers of feedlots and dairies were found. The aerial survey in Blackfoot identified 33 feedlots, 33 dairies, and one slaughterhouse. In contrast to feedlots of the Caldwell area, however, most feedlots in Blackfoot are small (fewer than 200 animals). Operations tend to show a rather clumped distribution, with the greatest numbers found in the Lago-Thatcher vicinity and Franklin-Mapleton area. Small clusters are found in Aberdeen, Mink Creek, Preston, Malad City, and at other scattered locations.

Approximately 71 and 48 percent of the identified feedlot and dairy operations, respectively, allowed cattle access to water. Many of these are in the 200-700 animal size category. This practice allows a heavy, year-round impact on streams through both streambank erosion and direct placement of manure. To protect streambanks, consideration should be given to fencing and stock-watering tank placement, particularly in areas where water quality is poor. Percentage of farms having direct access to water is higher in the Blackfoot area than any of the other study areas.

Sources Identified Through Complaints. The IDHW field office in Pocatello places low priority on dairies and feedlots (Hopson pers. comm.) and the office does not log complaints in their files. Correspondence in the files sometimes indicates indirectly, however, that complaints were received. Approximately 10 such references were noted, going back to 1974. The district health department also receives sporadic complaints, mainly for dairies and primarily in Caribou and Franklin Counties (Palmer pers. comm.). Feedlot complaints to the health department tend to be primarily for odors and flies, not water quality concerns.

As stated previously, the number of complaints does not reliably indicate the number of discharges that have occurred, except in a relative sense. Insufficient information exists in the state files to determine the status of complaints in this region. Existing information does suggest the majority of complaints are likely to be against dairies and the number has probably increased in the last few years. This area is probably of less overall concern than Twin Falls simply because of fewer operations. Some areas, such as the Bear and Cub River tributaries, require concentrated effort to improve water quality.

Table 2-13. Confined Animal Feeding Operations Identified by Aerial Survey in the Blackfoot Area

FEEDLOTS/SHEEP RAISING

SITE NO.	NAME[a]	FEEDING AREA (AC)	NO. ANIMALS	RECEIVING WATER[c]	ANIMAL ACCESS/ PEN DISTANCE TO WATERWAY (FT)	SLOPE[b]	IMPOUNDMENTS (#/ACRES)	LOCATION
32	Meyers Brothers Feedlots, Inc.*	26	>1000	Canal	None/20	F	2; 1.3 AC	Sugar City
34	Hoaghland Farms	1.7	<50	None	Direct access	F	None	Menan
36	Clement Brothers Livestock*+	16	201-700	USB 30	Direct access	F	4; 5 AC	Menan
37	Spur Cattle Co.*	50	701-1000	USB 30	Direct access	F	10; 28 AC	Lewisville
38	Harris-Idaho, Inc.*	47	>1000	None	None/215	F	10; 13 AC	Moreland
39	Sand Ridge Feeding Co.*	1.1	51-200	None	None/1400	F	None	Blackfoot
40	Beck Feedlot	10	201-700	USB 40	None/130	F	4; 1.5 AC	Aberdeen
41	Wan Iregogen	1.0	201-700	Lat. C.	None/10	F	None	Aberdeen
44	Albert Horsh	3	<50	None	None/20	F	None	Aberdeen
45	Ferrel Palmer	3.1	51-200	None	None/1750	F	None	Aberdeen
46	Morgan Anderson	1.0	201-700	None	None/105	M	None	Aberdeen
47	Clarence Schroeder	3.5	201-700	None	Direct access	M	None	Fairview
48	Clarence Schroeder	2.0	201-700	H.L. C.	Direct access	F	None	Fairview
50	Snake River Cattle Co., Inc.*	90	>1000	None	None/1970	F	12; 7.2 AC	Am. Falls
51	Roger Whitnak	6	201-700	None	Direct access	M	None	Borah
52	------------	3	51-200	USB 411	Direct access	F	1; 0.2 AC	McCammon
55	David Harris	2	None	BB 471	Direct access	F	None	Malad City
56	Morgan Harris	7	None	BB 471	Direct access	M	None	Malad City
57	Morgan Harris	3	None	BB 471	Direct access	S	None	Malad City
58	Currigan Brothers	5.2	51-200	Devils Cr	Direct access	F/M	None	Malad City
59	F. M. Deschamps	9.3	51-200	Unnamed	Direct access	M/S	None	Malad City
60	Ferron Burke	2	<50	BB 30[d]	Direct access	M	None	Lago
61	Ferron Burke	12	201-700	BB 30[d]	Direct access	F/S	1; 0.3 AC	Lago
62	Charles Izatt	3.3	51-200	BB 30[e]	Direct access	F	None	Lago
63	Dick Smith	1.5	<50	BB 30[e]	Direct access	M	None	Lago
66	Valero Bennett	0.5	None	BB 30[d]	Direct access	F	None	Lago
67	Floyd Toone	2	<50	BB 30[d]	Direct access	F	None	Lago
75	------------	1.4	<50	BB 30[d]	Direct access	F	None	Thatcher
76	------------	1	None	BB 30[d]	Direct access	F	None	Thatcher
80	Rockwood	0.5	<50	BB 410	Direct access	M	None	Mink Cr.
81	Christenson	2.8	<50	BB 410	Direct access	F/S	None	Mink Cr.
84	Bert Wheatley	1.3	51-200	BB 430	Direct access	F/S	None	Preston
85	Monty Moser	0.3	51-200	BB 430	Direct access	F	None	Preston
88	Lloyd Christensen	1.7	<50	BB 450	None/10	F	None	Franklin

DAIRIES

SITE NO.	NAME[a]	FEEDING AREA (AC)	NO. ANIMALS	RECEIVING WATER[c]	ANIMAL ACCESS/ PEN DISTANCE TO WATERWAY (FT)	SLOPE[b]	IMPOUNDMENTS (#/ACRES)	LOCATION
33	Hoaghland Farms	1	51-200	None	None/25	F	None	Sugar City
35	L. Skaar & Sons*	0.75	51-200	None	None/15	F	None	Menan
42	William Lehman	3	51-200	H.L. C.	Direct access	M	None	Aberdeen
43	Otto Klasen	1.5	51-200	None	Direct access	F	None	Aberdeen
49	Robert Shroeder	0.75	51-200	H.L. C.	Direct access	M	None	Fairview
53	------------	4.5	51-200	USB 411[g]	None/30	F	None	McCammon
54	------------	2.1	<50	USB 411[g]	Direct access	M	None	McCammon

Table 2-13. Continued

SITE NO.	NAME[a]	FEEDING AREA (AC)	NO. ANIMALS	RECEIVING WATER[c]	ANIMAL ACCESS/ PEN DISTANCE TO WATERWAY (FT)	SLOPE[b]	IMPOUNDMENTS (#/ACRES)	LOCATION
64	Trout Creek Dairy	6	51-200	BB 30[d]	Direct access	F	None	Lago
65	Allen Rudd	1	<50	BB 30[d]	Direct access	F	None	Lago
68	Horace Wright	1	51-200	BB 30[e]	None/30	F	None	Lago
69	Marvin Prescott	1	<50	BB 30	None/1800	M	None	Lago
70	Harris Mickelson	0.5	51-200	BB 30[d]	None/145	F	None	Lago
71	Clark Mickelson	0.5	<50	BB 30[d]	None/240	F	1; 0.7 AC	Lago
72	Daniel Mickelson	2.5	51-200	BB 30[d]	Direct access	F	None	Lago
73	Elvin Hubbard	1.5	51-200	BB 30[f]	Direct access	M	None	Thatcher
74	Lynn Turner	3	<50	Canal	None/35	S	None	Thatcher
77	Christenson	1.5	51-200	BB 410	Direct access	S	None	Mink Cr.
78	Christenson	3	51-200	BB 410	None/10	M	None	Mink Cr.
79	Christenson	4.5	51-200	BB 410	Direct access	F	None	Mink Cr.
82	Bob Landhardt	0.5	<50	BB 430	Direct access	F/S	None	Preston
83	Erickson Brothers	0.5	51-200	None	None/115	F	1; 0.2 AC	Preston
86	Gayle Moser	1.6	51-200	BB 430	None/10	F	None	Preston
87	Lloyd Christensen	1.3	<50	BB 450	None/10	F	None	Franklin
89	Lloyd Christensen	1.3	<50	BB 450	Direct access	F	None	Franklin
90	Lloyd Christensen	0.5	<50	BB 450	None/55	M	None	Franklin
91	------------	0.6	51-200	BB 450	Direct access	F	1; 1 AC	Franklin
92	------------	0.6	<50	Cub C.	None/385	F	None	Franklin
93	Stanton Hawkes	3.1	201-700	BB 450	Direct access	F	None	Franklin
94	Kenneth Hawkes	0.2	<50	BB 450	None/220	F	None	Franklin
95	Walter Knapp	2.4	<50	BB 450	None/935	F	None	Franklin
96	William Wright	7.5	51-200	BB 450	Direct access	F	None	Franklin
97	William Wright	1.4	51-200	Unnamed	Direct access	F	None	Franklin
98	William Wright	3.7	51-200	None	None/90	F	None	Franklin

---

[a] + = Slaughterhouse; * = Permitted.
[b] F = Flat; M = Moderate; S = Steep.
[c] USB 30 - Snake R (Roberts - Am. Falls Res.)
USB 40 - Snake R (Am. Falls Res.)
USB 411 - Marsh Cr (Source - mouth)
BB 471 - Little Malad R (Source - mouth)
BB 410 - Mink Cr (Source - mouth)
BB 430 - Worm Cr (Source - ID/UT border)
BB 450A - Cub R (Mapleton - Franklin)
BB 30 - Bear R (Soda Sp. - UPL Tailrace)
[d] Via Trout Cr
[e] Via Whiskey Cr
[f] Via Burton Cr
[g] Via Unnamed stream

SOURCE: EPA 1984c and Morrison, pers. comm.

Because of the lack of complaint information and lack of identification for operations located by the aerial survey, it is difficult to determine the dairies and feedlots potentially requiring permits in the Blackfoot area. It is likely that most operations in Blackfoot that should have a permit would require it because of their water quality impact, not their size.

Status of Previously Permitted Operations. Table 2-14 summarizes the relationship between permits and impoundments for the Blackfoot area. Eight of the 34 feedlots/slaughterhouses (24%) photographed had impoundments. Although the aerial survey indicates five of the seven previously permitted feedlots have impoundments, it is likely that some of these, in actuality, have none. Spur Cattle Company and Harris-Idaho, for example, are identified as having 50 and 47 acres of feeding area, respectively, with 28 and 13 acres identified as "impoundments." It seems more likely that these large areas are merely standing water which appears as impoundments in the photo. While this arrangement probably protects river water quality to some extent, it appears to be more of a beneficial accident than an attempt to implement BMP.

None of the dairies in the Blackfoot area has ever been issued a permit. Only three of the 33 had impoundments of any type. As dairies generally produce milkroom washwater year-round, the presence of an impoundment or treatment facility of some type is of somewhat greater importance than it is for feedlots.

Miscellaneous Operations

During data collection, a number of other operations having permit numbers were identified in the permit files. Several operations were issued a number and later determined to be exempt from the permit requirements. Others received a permit which was later cancelled. Only one permitted operation (Victorio Co.) was not previously listed as it is located far to the north of the study area. Status of these miscellaneous facilities throughout the state is given in Table 2-15 primarily as an aid to state record keeping.

Impact of Existing Sources

Water quality data for stream segments in the study area was reviewed to determine areas where agricultural pollution is of most concern and to identify areas of poor water quality. Sources were also assessed in terms of their pollution potential, based on information in the aerial photo survey, complaint file information, and contacts with SCS and IDHW field personnel.

Table 2-14. Relationship Between Permits, Impoundments, and Complaints in the Blackfoot Area

	PREVIOUSLY PERMITTED	SURVEYED		SURVEYED & PERMITTED		SURVEYED & UNPERMITTED		SURVEYED & PERMITTED, WITH COMPLAINT[a]		TOTAL COMPLAINTS (1977-1984)[a]	
		PERM.	NONPERM.	IMPOUND.	NO IMPOUND.	IMPOUND.	NO IMPOUND.	IMPOUND.	NO IMPOUND.	PERM.	NONPERM.
Beef Feedlot	10	7	27	5	2	3	24	ND	ND	ND	ND
Dairy/ Poultry	0	0	33	-	-	3	30	ND	ND	ND	ND
TOTAL	10	7	60	5	2	6	54				

---

[a] Could not be determined due to lack of complaint records at regional IDHW office.

SOURCES: EPA permit files; EPA 1984b; IDHW files.

Table 2-15. Status of Miscellaneous Operations Referred to in IDHW Files

PERMIT NUMBER	STATUS	NAME	AREA
002467-8	Exempt	Blincoe Farms, Inc.	--
002389-2	Exempt	Circle C Ranch Co.	--
002421-0	Exempt	Donald K. Van Buren	--
002229-2	Exempt	Garrerd Land and Cattle Co.	Twin Falls
002208-0	Exempt	J. R. Simplot Co.	--
002283-7	Exempt	H & A Land & Cattle, Inc.	Shoshone
002158-0	Cancelled (1/4/79)	Houghland Farms, Inc.	Springfield
002225-0	Exempt	Quentin Murdock	--
002317-5	Exempt	Snake River Farms	--
002318-3	Exempt	Twins Falls Livestock Commission	--
002146-6	Cancelled (3/4/76)	Treasure Valley Heifer Co. (Holstein Heifer Ranch McGill Unit)	-- Star
002114-8*	Expired (5/28/79)	Victorio Co.	Salmon (discharge to Lemki R)

---

* Previously permitted operation lying outside of the study area.

Potential Impacts From Confined Animal Feeding Operations

Wastes generated by individual feedlots and dairies vary depending on the type of operation, the extent to which wastes may include bedding, barn, stall, or milkroom waste and the degree to which these mix with runoff water. On a per capita basis, dairy cows also generate greater quantities of waste than beef cattle, although water quality impacts from all operations are similar.

Animal waste contains a number of pollutants which can impact water quality. The most commonly recognized contaminants are suspended solids and organics, bacteria, and nutrients (nitrogen and phosphorus compounds). They have been observed to cause a number of water quality problems:

- Organic materials decrease dissolved oxygen concentration, which may impact aquatic fauna.
- Solids affect aesthetics by causing coloration, turbidity, and odor problems.
- Settling of manure particles in streambeds changes the substrate and destroys spawning areas.
- Suspended particles may kill aquatic organisms by suffocation.
- Bacterial/viral concentrations increase potential spread of disease and other public health concerns. Organisms such as *Vibrio*, *Rotavirus*, *Salmonella*, and others are spread through dairy waste discharges.
- Mobile nutrients, particularly nitrates, may cause groundwater contamination. High nitrate levels pose a health hazard to young children, who are susceptible to methemoglobinemia.
- Nitrogen and phosphorus compounds may kill aquatic organisms through ammonia toxicity.
- Nitrogen compounds may cause eutrophication of streams and lakes by increasing aquatic plant growth, which leads to reduced flow, decreased light penetration, and fish kills.
- Discharge to irrigation canals clogs irrigation intake pipes and/or reduces the quality of water available to irrigators.
- Discharge to canals increases growth of moss and aquatic plants, decreasing flow efficiency and raising canal maintenance costs.

These general impacts have all been noted in the study area. Twin Falls IDHW complaint and enforcement files contain reports linking animal wastes to human disease in at least one instance, and linking discharges to fish kills, irrigation intake pipe blockage, nuisance weed growth in canals, and water quality degradation in several others. Weed growth greatly increases canal operational costs, and it is also responsible for an additional secondary aquatic impact. Chemicals such as xylene and acrolein, used to control algal growth in canals, are also extremely toxic to fish. Contaminated water resulted in a number of documented fish kills, particularly in the Twin Falls vicinity. Several fish kills have been recorded caused by chemicals often used in canals for weed control, although reason for the use of the chemicals was not given.

Other nuisance and health impacts from dairies and feedlots include generation of odors, flies, and occasionally fugitive dust. Although these are normally of less ecologic importance, people appear more willing to complain about these impacts than water quality impacts, perhaps because they are more directly affected by them.

A number of poor management practices may result in water quality degradation. Inadequate control of runoff from animal confinement areas, poor manure storage and handling practices, field application of manure at improper times or during wet weather, or seepage from storage areas to canals, ditches, or streams all contribute to the impact of manure on waterways. Properly constructed facilities and proper operation, maintenance, and management practices are necessary to maintain water quality.

The prime concern of this study is runoff from animal confinement areas and the overflow of impoundments which often accompanies increased runoff. Tables 2-16 and 2-17 provide characteristics of cowyard runoff waste generally expected for dairy cows and beef cattle. Table 2-18 provides characteristics of waste generally expected from a cowyard and milking center. Amount of actual runoff will vary depending on the on-site conditions, but these tables provide a general idea of the kinds and concentrations of pollutants expected from many operations in the study area.

Laboratories analyses of runoff from Idaho operations show coliform levels up to 1,300,000/100 ml, BOD of up to 650 mg/l, and turbidity up to 508 NTU (Appendix B). These analyses are probably representative of runoff quality, but few, if any, actual runoff studies have been made in Idaho. There are a number of researchers in other areas who have reported runoff quality from cattle feedlots, however. "Average" concentrations of pollutants in direct runoff discharge and water discharged from collection ponds are shown in table 2-19. These measurements were made in Texas, but the author believes them to be representative of other areas as well. While both discharges are still high in solids, COD, and some other parameters, the

Table 2-16. Waste Runoff from a Dairy Confinement Area[a]

PARAMETER	LB/HEAD/INCH RUNOFF			mg/l		
	MINIMUM	AVERAGE[b]	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM
Total (wet solids)	No data	1,040.0	No data	-	-	-
Moisture	No data	1,031.7	No data	No data	992,000	No data
Dry solids	No data	8.32	No data	No data	8,000	No data
Volatile solids	No data	3.95	No data	No data	4,000	No data
Suspended solids	No data	No data	No data	No data	No data	No data
pH	No data	No data	No data	No data	No data	No data
BOD_5	No data	1.56	No data	No data	1,500	No data
COD	No data	3.64	No data	No data	3,500	No data
Ash	No data	4.37	No data	No data	No data	No data
Total nitrogen	No data	0.16	No data	No data	150	No data
Ammonia nitrogen	No data	No data	No data	No data	No data	No data
Nitrate nitrogen	No data	No data	No data	No data	No data	No data
Total phosphorus	No data	0.08	No data	No data	80	No data
Total potassium	No data	0.35	No data	No data	340	No data
Magnesium	No data	No data	No data	No data	No data	No data
Sodium	No data	No data	No data	No data	No data	No data

---

[a] Assumes 200 square feet confinement/head and average animal weight of 1,300 pounds.

[b] Estimated values.

SOURCE: EPA 1974.

Table 2-17. Waste Runoff from a Feedlot Confinement Area[a]

PARAMETER	LB/HEAD/INCH RUNOFF			mg/l		
	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM
Total (wet solids)	-	1,040.0	-	-	-	-
Moisture	1,024.4	1,031.7	1,034.4	985,000	992,000	994,000
Dry solids	6.24	8.32	15.0	6,000	8,000	15,000
Volatile solids	3.95	4.16	8.32	3,800	4,000	8,000
Suspended solids	1.04	2.6	5.20	1,000	2,500	5,000
pH	5.1	7.6	9.4			
BOD_5	1.04	1.56	6.23	1,000	1,500	5,000
COD	3.12	3.64	31.2	3,000	3,500	20,000
Ash	2.08	4.37	7.8	2,000	4,200	7,500
Total nitrogen	0.02	0.16	0.14	20	150	1,100
Ammonia nitrogen	0	0.06	0.52	0	60	500
Nitrate nitrogen	0	0.03	0.12	0	25	120
Total phosphorus	0.01	0.08	0.22	14	80	200

---

[a] Assumes a moderately sloped dirt yard allowing 200 square feet confinement/head and average animal weight of 800 pounds.

SOURCE: EPA 1974.

Table 2-18. Waste Expected from a Dairy Cattle Yard and Milking Center[a]

PARAMETER	KG/HEAD/DAY (LB/HEAD/DAY)			mg/l		
	MINIMUM	AVERAGE[b]	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM
Total (wet solids)	No data	84.0	No data	-	-	-
Moisture	No data	83.2	No data	No data	990,500	No data
Dry solids	No data	0.8	No data	No data	9,530	No data
Volatile solids	No data	No data	No data	No data	No data	No data
Suspended solids	No data	0.22	No data	No data	2,620	No data
pH	No data	8.0	No data	No data	No data	No data
BOD_5	No data	0.38	No data	No data	4,530	No data
COD	No data	No data	No data	No data	No data	No data
Ash	No data	No data	No data	No data	No data	No data
Total nitrogen	No data	0.15	No data	No data	1,790	No data
Ammonia nitrogen	No data	0.05	No data	No data	596	No data
Nitrate nitrogen	No data	No data	No data	No data	No data	No data
Total phosphorus	No data	0.015	No data	No data	179	No data
Total potassium	No data	No data	No data	No data	No data	No data
Magnesium	No data	No data	No data	No data	No data	No data
Sodium	No data	No data	No data	No data	No data	No data

---

[a] Assumes average dairy cow of 1,300 lbs and (presumably) a 200 square foot confinement area/head.

[b] Although the source does not so indicate, it is presumed that values for this table are estimates, as is the case with those of similar format within the same report.

SOURCE: EPA 1974.

Table 2-19. Average Concentrations of Selected Chemical Parameters Found In Direct Runoff from Feed Pens and in Discharge Water from Collection Ponds

	DIRECT RUNOFF	DISCHARGE WATER
Biochemical Oxygen Demand (mg/l)	2201	558
Chemical Oxygen Demand (mg/l)	7210	2313
Total Solids (mg/l)	11429	3172
Total Dissolved Solids (mg/l)	5526	1875
Organic Nitrogen (mg/l)	228	64
Total Phosphate (mg/l)	70	38
Ammonia (mg/l)	108	50

SOURCE: Duffer and Kreis 1971, *in* Shuyler et al. 1973

Table 2-20. Pollutant Concentrations in Runoff from a Concrete Lot During a Single Storm Event

TIME OF COLLECTION[a]	pH	BOD (mg/l)	COD (mg/l)	NO (mg/l)	NH_3-N (mg/l)	ORG-N (mg/l)	ALKY (mg/l)
11:35 p.m.	6.60	16,800	48,000	625	525	532	2,595
11:58 p.m.	6.80	5,120	20,451	975	526	315	1,955
12:25 a.m.	6.65	7,400	22,032	1,000	485	36	2,000
2:25 a.m.	6.80	9,950	23,316	900	543	285	1,865

---

[a] Precipitation beginning 11:00 p.m., August 24, 1969

SOURCE: Texas Tech University 1970 *in* Shuyler et al. 1973 increased quality from the discharge pond indicates the value of impoundment construction.

Runoff can be extremely concentrated and of high pollution potential. Runoff concentrations are greatly affected by amount and duration of a runoff event. "First flush" runoff can be particularly high in pollutants. Table 2-20 indicates the change in pollutant levels in runoff over time.

The high BOD levels are one reason for fish kills, as they deplete the dissolved oxygen levels in the receiving water. The reaction of a stream to a slug of feedlot runoff passing a sampling point in the stream is shown in table 2-21. The time for the stream to regain sufficient oxygen levels can be quite long, depending on a number of factors including waste breakdown and stream characteristics.

Because it may be considerable, the impact of animal access to waterways should not be overlooked when assessing impacts of confined animal operations on water quality. Streambank trampling greatly increases erosion and downstream sedimentation of spawning areas and other aquatic habitat. Animal access also allows direct placement of manure into the water. Animal impacts thus become a year-round problem, unlike impoundment discharges which occur primarily when excess precipitation or poor maintenance cause an overflow. Unlike an impoundment discharge, unrestricted animal access produces essentially a nonpoint source impact. It is important to understand and control the impact through management practices, stipulated if possible, in conjunction with permit conditions.

Water quality degradation from animal confinement areas occurs primarily in winter and spring. During these periods, there is increased precipitation while soils are either likely to be frozen or saturated. Both conditions decrease soil infiltration capacity. Greater runoff quantities are likely to be generated, but less than normal amounts of water can be retained on site. If rains occur when snow is present, meltwater will further increase runoff volume. Under such conditions, runoff may even exceed rainfall volume.

Animal manure has traditionally been viewed primarily as waste, or more recently, as a pollutant. While the polluting aspects of improperly managed wastes are obvious, it should not be overlooked that on the average, a 1,000 pound cow can produce up to 135 pounds of nitrogen, 58 pounds of phosphorus, and 87 pounds of potassium per year (ADA SCD 1982). When viewed in this light, manure becomes a resource which can reduce farmer costs when used properly. Developing a waste management system is the key to effective use of these nutrients; it will benefit both the farmer and the environment. To be effective, farm management planning and use of BMPs should be tailored to meet individual farmer needs. Elements of a management plan are discussed in Chapter 4.

Table 2-21. Reaction of a Stream[a] to a Slug of Feedlot Runoff Passing a Sampling Point during a Single Storm Event and Comparison to Dry Weather Values

	WATER QUALITY PARAMETERS (MG/L)				
TIME	DO	BOD_5	COD	Cl	NH_3
Avg. Dry Weather Values	8.4	2	29	11	0.06
13 hours	7.2	8	37	19	12.0
20 hours	0.8	90	283	50	5.3
26 hours	5.9	22	63	35	-
46 hours	6.8	5	40	31	0.44
69 hours	4.2	7	43	26	0.02
117 hours	6.2	3	22	25	0.08

---

[a] Fox Creek near Strong City, Kansas, November 1962

SOURCE: Smith and Miner 1964 *in* Shuyler et al. 1973

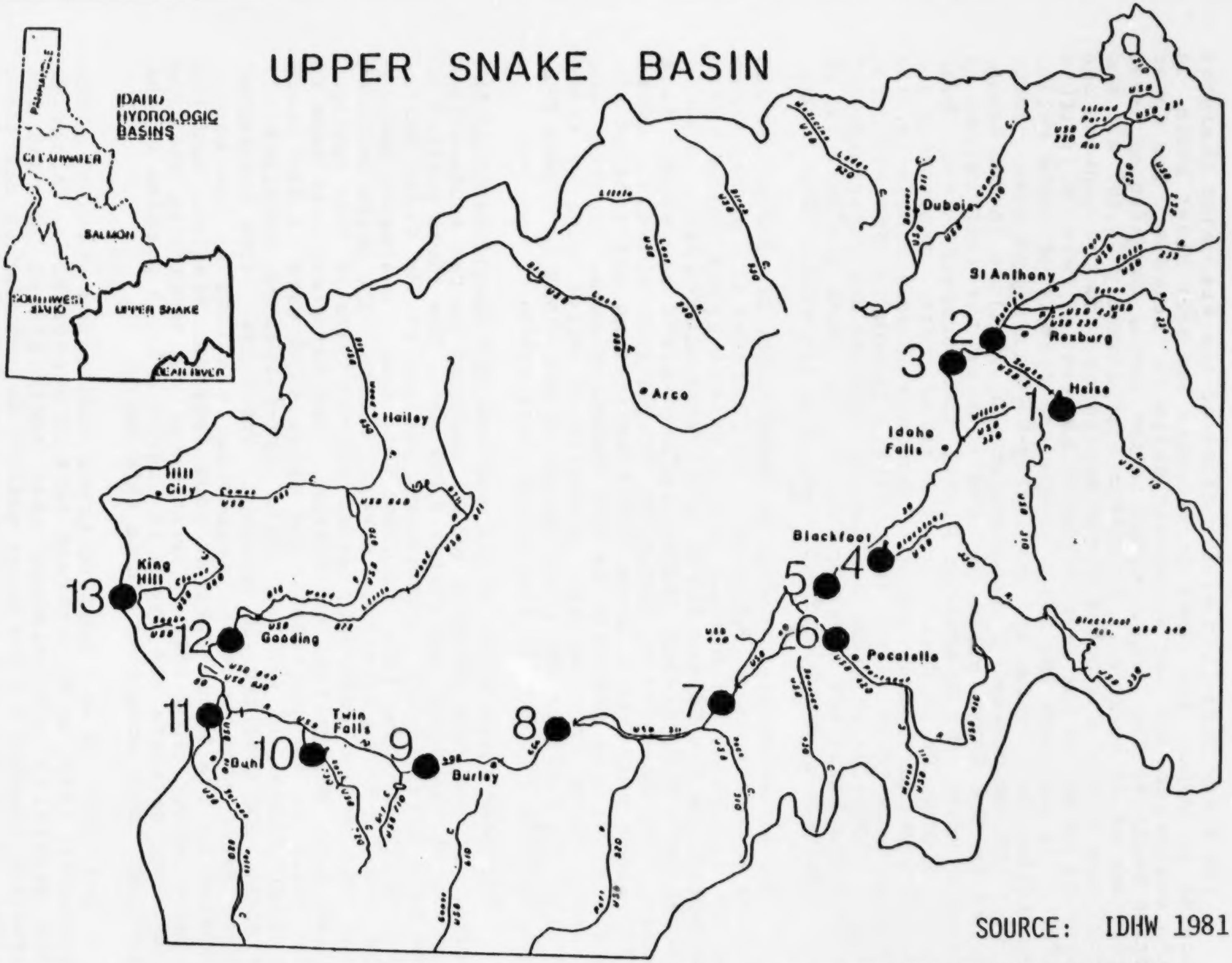
Stream Segment Characterization and Priority Segments

The study area lies within three of the six major drainage basins in Idaho: the Upper Snake Basin and Bear River Basin, in the southeast, and the Southwest Basin to the west. The Upper Snake Basin is the largest basin in the state, covering at least portions of 22 counties. It drains approximately 28,400 mi^2 and includes all of the Snake River drainages from the Montana and Wyoming border on the east to King Hill, west of Twin Falls (IDHW 1981). It includes the major population centers of Idaho Falls, Pocatello, Twin Falls, and the Burley-Heyburn-Rupert area. Until 1983, IDHW maintained 13 trend monitoring stations in the basin, seven on the Snake River and one each on the tributaries of Henry's Fork, the Blackfoot River, the Portneuf River, Rock Creek, Salmon Falls Creek, and the Malad River. Monitoring was discontinued as a large amount of data was already available, few changes were being noted, and analysis is costly (Shepard pers. comm.). Location of trend monitoring stations and river segments within the basin are shown in Figure 2-1. Both the Twin Falls and a portion of the Blackfoot study area lie within this basin.

The Southwest Basin covers at least parts of 12 counties and drains approximately 19,250 mi^2. It includes all of the Snake River drainages from King Hill, on the Upper Snake Basin boundary, to the Salmon River confluence (IDHW 1981). Some of the state's most highly industrialized areas lie within this basin, including Boise, Meridian, Nampa, and Caldwell. Until 1983, IDHW maintained three trend monitoring stations on the Snake River and one each on the Boise, Wieser, Payette, and Bruneau River tributaries. Location of water quality trend monitoring stations and river segments are shown in Figure 2-2. The Caldwell survey area lies within this basin.

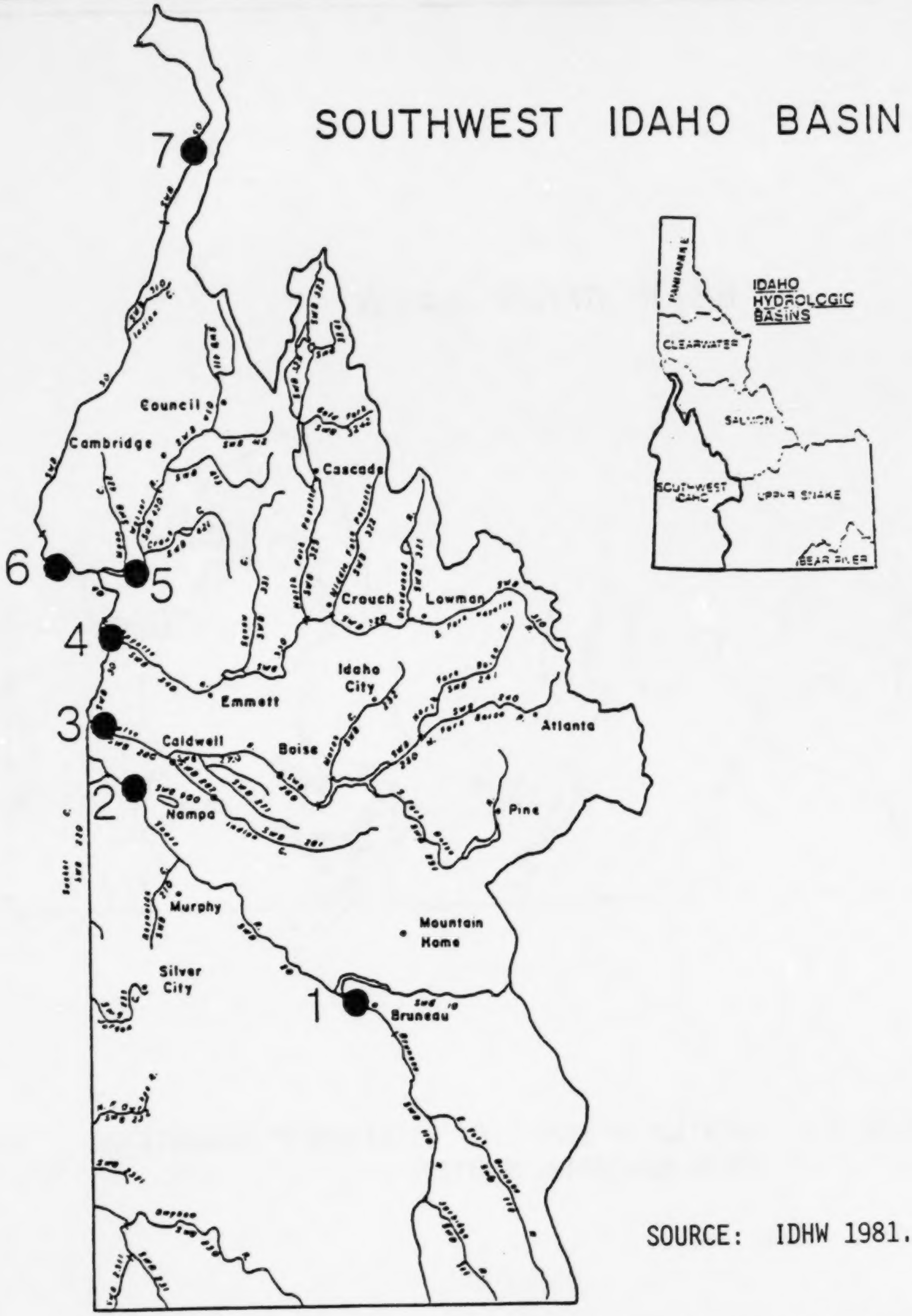
The Bear River Basin is the smallest hydrologic basin in the state. It includes portions of six counties in the southeastern portion of the state and drains 2,695 mi^2. The Idaho portion of the Bear River is the northernmost portion of the Great Basin, eventually draining into the Great Salt Lake. Drainages include the Bear and Malad Rivers and several creeks. The basin includes Bear Lake on the Idaho-Utah border and the towns of Soda Springs, Malad City, Montpelier, and Preston. The major economic base in the basin is agricultural, and major land uses in the basin include rangeland (50 percent), non-irrigated cropland (30 percent), and woodland (20 percent). Until 1983, IDHW maintained three water quality trend monitoring stations in the basin, located on the Bear River at Soda Springs, Preston, and the Wyoming border (IDHW 1981). Location of the monitoring stations and river segments are shown in Figure 2-3. A portion of the Blackfoot study area lies within this basin.

The IDHW has not sampled trend monitoring stations since September, 1983, so more recent data is unavailable. Although IDHW generally acknowledges that agricultural sources are primarily responsible for water quality degradation in all three basins, it is difficult to correlate water quality changes within


UPPER SNAKE BASIN
IDAHO HYDROLOGIC BASINS
PANHANDLE
CLEARWATER
SALMON
SOUTHWEST IDAHO
UPPER SNAKE
BEAR RIVER
St Anthony
Rexburg
Heise
Idaho Falls
Dubois
Arco
Hailey
Hill City
King Hill
Gooding
Twin Falls
Burley
Blackfoot
Pocatello
1
2
3
4
5
6
7
8
9
10
11
12
13

SOURCE: IDHW 1981.

FIGURE 2-1. LOCATION OF UPPER SNAKE BASIN STREAM SEGMENTS AND TREND MONITORING STATIONS


SOUTHWEST IDAHO BASIN
7
6
5
4
3
2
1
Council
Cambridge
Cascade
Crouch
Lowman
Idaho City
Emmett
Caldwell
Boise
Atlanta
Nampa
Pine
Murphy
Mountain Home
Silver City
Bruneau
IDAHO HYDROLOGIC BASINS
PANHANDLE
CLEARWATER
SALMON
SOUTHWEST IDAHO
UPPER SNAKE
BEAR RIVER

SOURCE: IDHW 1981.

FIGURE 2-2. LOCATION OF SOUTHWEST IDAHO BASIN STREAM SEGMENTS AND TREND MONITORING STATIONS

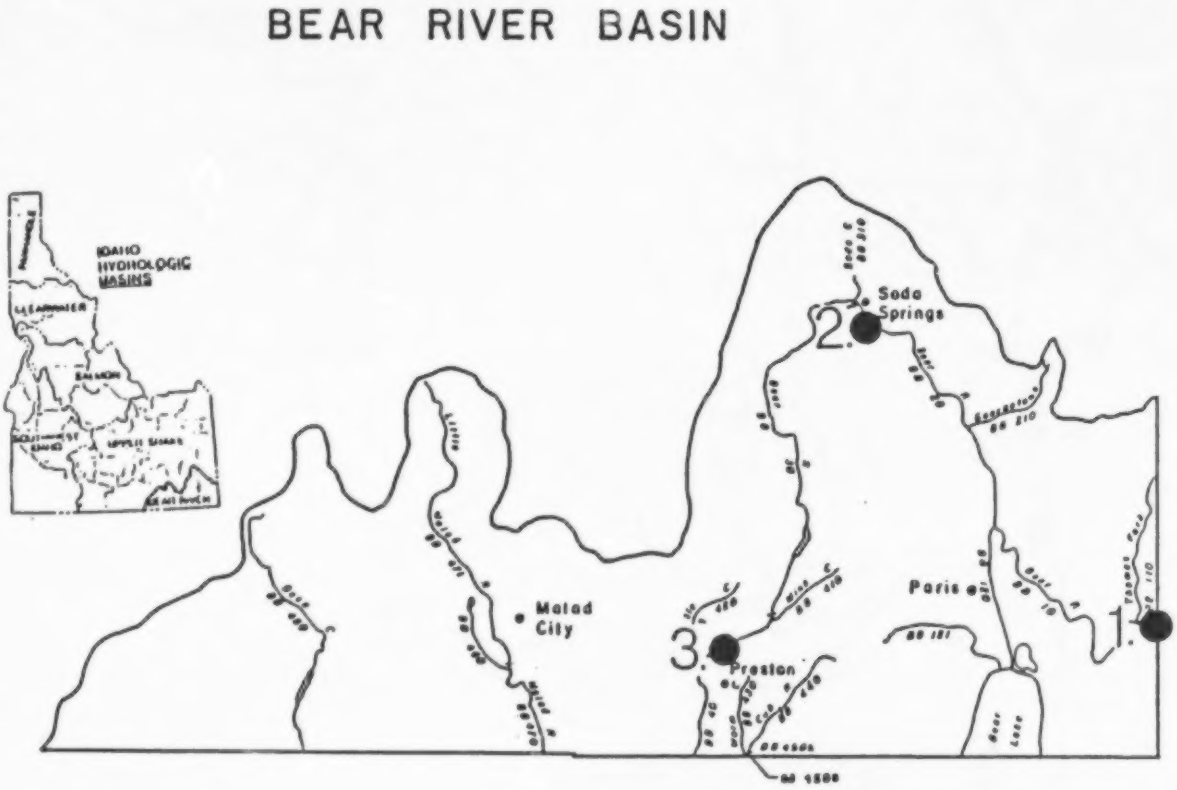

BEAR RIVER BASIN
IDAHO HYDROLOGIC BASINS
Soda Springs
2.
Paris
1.
Malad City
3.
Preston

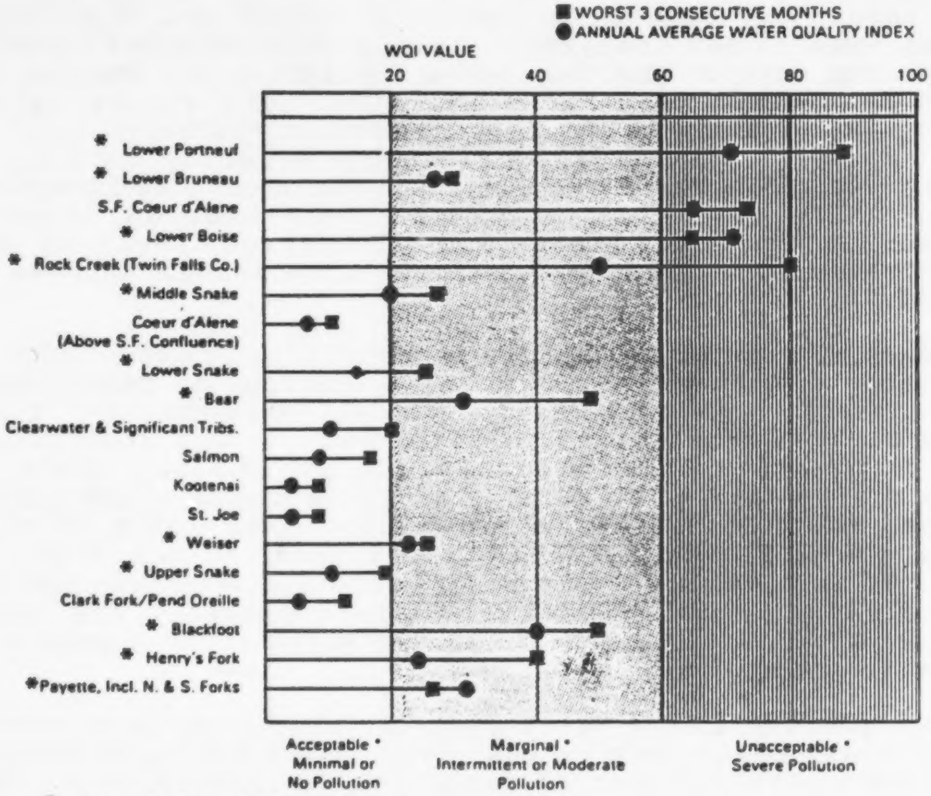
FIGURE 2-3. LOCATION OF BEAR RIVER BASIN STREAM SEGMENTS AND TREND MONITORING STATIONS

SOURCE: IDHW 1981.

a river segment to feedlot or dairy impoundment discharges and runoff. Data concerning input from various other types of sources, particularly nonpoint source activities, are scarce; runoff or impoundment discharges are often brief events, and river sampling occurred only once a month (and probably during good weather, when possible). For example, a large number of feedlot runoff complaints were received on May 17, 1982; the monthly routine river monitoring scheduled on May 15 did not, of course, record any impact. A number of individual discharges have been sampled and analyzed; quality of discharges leaving farms has thus been documented, and a few laboratory reports are provided in Appendix B. But a lag time often exists before discharges impact a waterway. Many operations discharge first to a canal or creek; few actually discharge directly to a major river segment. Discharges may be noticeable only to immediate neighbors. In addition, in areas where flow is closely regulated, use for power generation, irrigation diversion, and agricultural return flows all help to mask actual changes in water quality.

IDHW evaluates water quality in the basins by use of a Water Quality Index that provides a combined evaluation of temperature, dissolved oxygen, pH, aesthetics, solids, radioactivity, fecal coliform bacteria, nutrients (trophic level), and organic and inorganic toxicity. Actual measured values for these 10 parameters are compared to water quality criteria, normalized, and summed to produce the index value. This index makes a relative quality comparison of individual stream segments possible. It also establishes various pollution standards against which individual river segments can be compared. The index values for 1983 are shown for all of the major river segments of the state in Figure 2-4.

Water quality in the Snake River is very high as it enters the Upper Snake Basin; but as the river flows westward through the Southwest Basin, bacterial densities, nutrients, suspended solids, and turbidity increase. Elevated summer temperatures also become a problem (IDHW 1983a). Nearly all of the river segments within the study area are classified as having marginal annual water quality (moderate or intermittent pollution), and a few, such as the Portneuf River, lower Boise River, and Rock Creek, fall into the unacceptable (severe pollution) range. High priority problem areas within the state river systems are shown in Figure 2-5. It should be noted that in 1983, the 1982 priority areas map was expanded to include three new high-priority areas located in the Bear River Basin, the Salmon River Basin, and the southern part of the Panhandle Basin (Figure 2-5a). One area, the Little Wood River, was removed from the high priority listing. In 1984, priority areas were again expanded (Figure 2-5b) to include the Portneuf River, the Payette River, the Lower Wood River, and a number of new areas in the Salmon River, Clearwater River, and Panhandle Basin. Assuming the same criteria are used annually to develop IDHW's priority areas, a progressive downward trend in water quality appears to be occurring. This is borne out by IDHW data (Figure 2-6).



* IN STUDY AREA BASINS

FIGURE 2-4. WATER QUALITY INDEX VALUES FOR IDAHO'S PRINCIPAL RIVERS (1983)

SOURCE: IDHW 1983A.

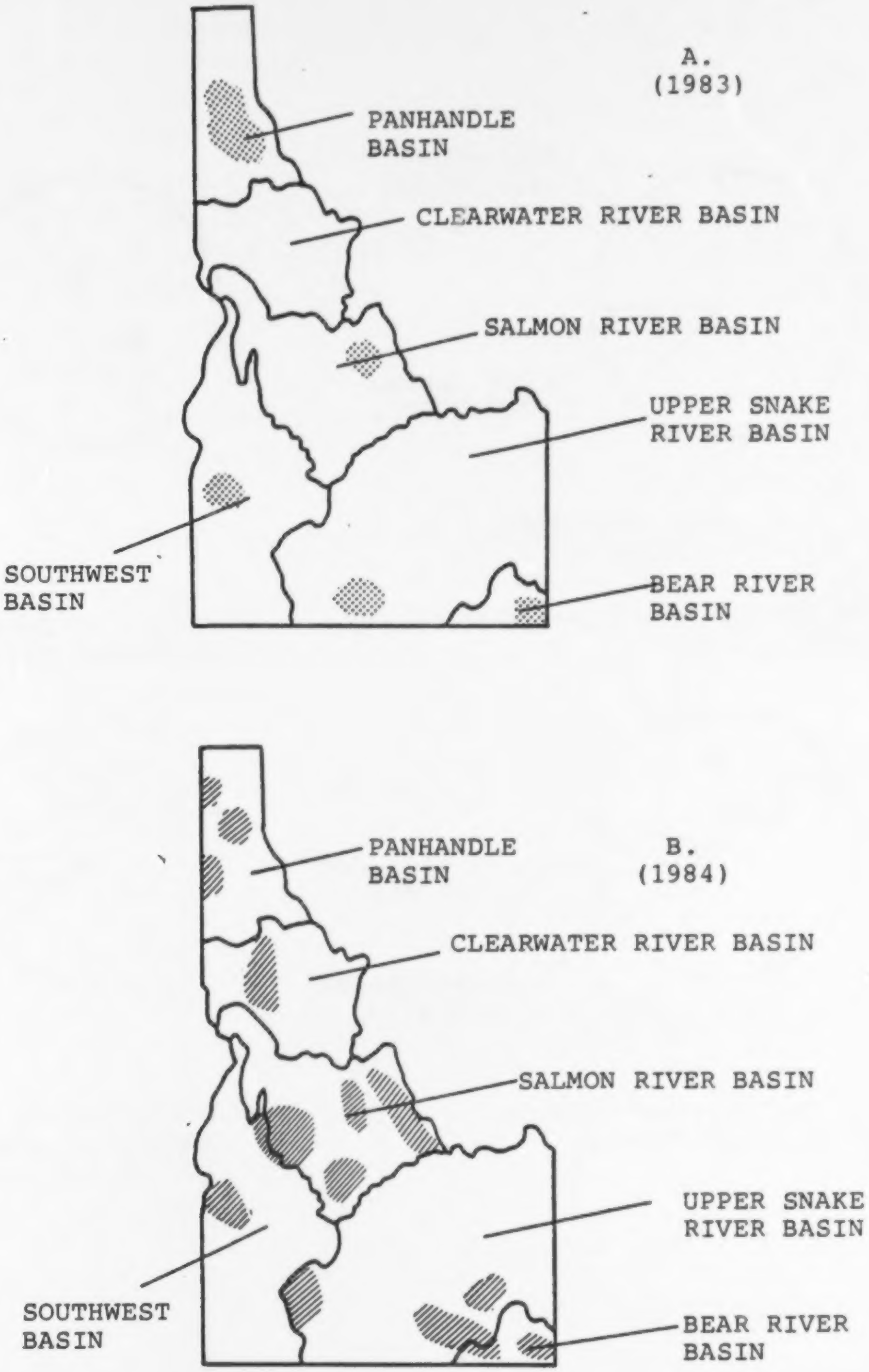
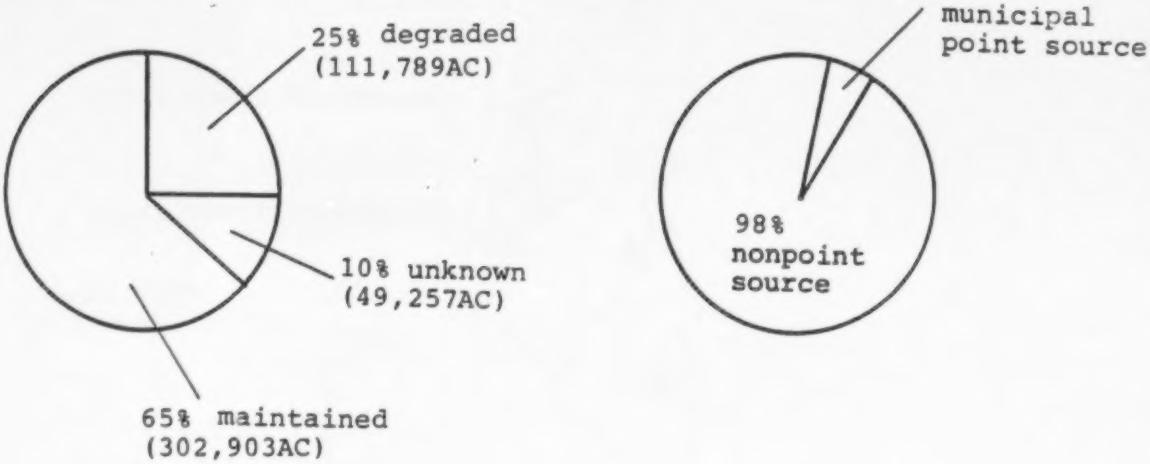

A.
(1983)
PANHANDLE BASIN
CLEARWATER RIVER BASIN
SALMON RIVER BASIN
UPPER SNAKE RIVER BASIN
SOUTHWEST BASIN
BEAR RIVER BASIN
PANHANDLE BASIN
B.
(1984)
CLEARWATER RIVER BASIN
SALMON RIVER BASIN
UPPER SNAKE RIVER BASIN
SOUTHWEST BASIN
BEAR RIVER BASIN

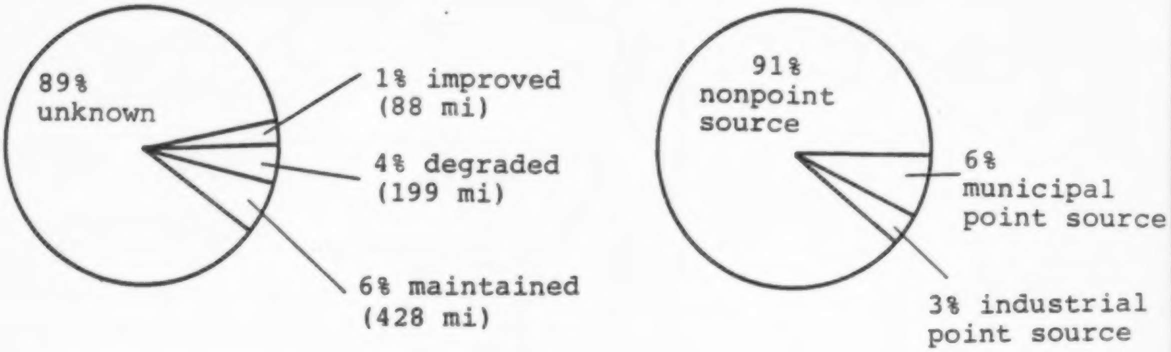
FIGURE 2-5. HIGH PRIORITY WATER QUALITY AREAS

SOURCES: IDHW 1983A; IDHW 1984B



Water Quality/Use Support (1972-1982)
in Idaho Lakes

Pollution Sources (1982)
Impacting Idaho Lakes



Water Quality/Use Support (1972-1982)
in Rivers and Streams

Pollution Sources (1982)
Impacting Idaho
Rivers and Streams

FIGURE 2-6. POLLUTION SOURCES AND GENERAL TRENDS IN LAKE, RIVER, AND STREAM SEGMENTS

River segments within the Upper Snake Basin (Blackfoot and Twin Falls study areas) support a number of beneficial uses, including domestic and agricultural water supply, recreation, cold-water fisheries, and salmonid spawning. Overall water quality in this basin is rated as fair by IDHW. The only portions of the study area in this basin considered high priority by IDHW are the Rock Creek area southeast of Twin Falls and Deep and Cedar Draw Creeks. Eight priority segments exist within the entire basin, although dairies and feedlots appear to have significant (estimated 20%) impact only in Deep and Cedar Draw Creeks (IDHW 1985b). The pollutants of greatest threat to the beneficial uses are bacteria, nutrients, and solids, all of which are generated by animal wastes. Within this basin, the progressive westward degradation is caused primarily by agricultural activities.

Many river segments in the Southwest Basin (Caldwell study area) support recreational activity, cold-water fisheries, and salmonid spawning, as well as domestic water use. Water quality in this basin is rated fair by IDHW. The portions of the study area in this basin considered high priority by IDHW are the lower Boise River, one of the poorest quality segments in the state (IDHW 1983a), and the Payette River. Five priority segments exist within the entire basin, but only the Boise and Payette Rivers appear to have significant dairy and feedlot impact (IDHW 1984b). Both point and nonpoint sources contribute to use impairment, although it is believed that agricultural activity is the primary cause of degradation and that the greatest potential water quality benefits would result from improvement of agricultural management practices (IDHW 1983b).

River segments in the Bear River Basin (southern portion of the Blackfoot study area) support a number of beneficial uses including agricultural water supply and contact recreation. Uses of greatest concern are fishing and recreation. Water quality in this basin is rated poor by IDHW. Three of the five high priority segments in this basin fall within the study area. These include Worm Creek, the Little Malad River, and the Cub River. Because the Bear River is the major tributary to Bear Lake, it directly affects water quality in the lake, and nutrient and sediment loading are of concern. In 1983, a Clean Lakes Project was completed for Bear Lake and 3-state funding is being sought to implement a basin plan to improve water quality in the drainage area.

Water quality at the Wyoming-Idaho border is affected by sediment and high turbidity and phosphorous levels. Nitrates from natural springs and municipal discharges, and bacteria from agricultural drainage and municipal discharges, both increase in downstream segments. The drainage has naturally high dissolved solids levels compared to those of other basins because of salt springs near Preston. Although point sources include municipal effluent from Preston and Soda Springs, the major water quality impact comes from agricultural pollution (IDHW 1981, 1983a). Seasonal highs of bacteria, sediment, turbidity, and phosphorous correspond to periods of runoff. Table 2-22 summarizes present and future protected beneficial uses for water segments within the three drainage basins.

The water quality index provides one way to prioritize water segments based on existing data. It is also possible to prioritize water segments in terms of potential pollution. This can be done by analyzing the condition, number, and size of animal confinement areas which drain to various stream segments. This method cannot assess impact with complete accuracy; many small dairies and feedlots not included in the aerial survey may cumulatively have significant impact. Certain areas do seem to warrant greater concern than others, however, based solely on the number of operations draining to a particular river segment. The sources draining to river segments within the three basins are summarized by size and number in Table 2-23. As the aerial survey did not include many sources, this table underestimates numbers but nevertheless provides some relative information by which to compare river segments.

In the Caldwell area, segment SWB 280 (Boise River from Caldwell to mouth) and segment SWB 20 (Snake River from Strike Dam to the Boise River) appear to be the most potentially impacted. The majority of the larger (over 200 animal) farms are located within these drainages. Many have no impoundments and often allow direct animal access or lie within short distance of a waterway. This finding tends to support IDHW's index values and their contention that the lower Boise is one of the worst water quality segments in the state. It also tends to support the assumption that control of agricultural sources in general within these segments should be a priority.

In the Twin Falls area, Deep Creek (USB 810), the Big Wood (USB 850), and Little Wood Rivers (USB 871) appear to be priorities although a great number of sources were missed in this region. The Bear and Cub Rivers (BB 30 and BB 450A) appear to be of greatest concern in the Blackfoot area, followed by Mink and Worm Creeks (BB 410 and BB 430). This agrees with IDHW information supplied through personal communications. Degradation in these areas results from a cumulative impact of numerous small sources.

Groundwater Concerns

In considering feedlot and dairy waste management options, surfacewater pollution should not be the only concern. The Snake River Plain Aquifer underlies much of the Snake River. It discharges via numerous springs in the area between Hagerman and Twin Falls. Many of these springs support aquaculture projects such as trout hatcheries. Citizens of Hagerman have petitioned the EPA to designate the aquifer (primarily in the area from Hagerman eastward to approximately St. Anthony) as a Sole Source Aquifer. This designation would require any federal projects in

Table 2-22. Designated Uses of Water Segments Within the Caldwell, Twin Falls, and Blackfoot Study Areas

SEGMENT NUMBER	WATERS	DOMESTIC SUPPLY	AGRICULTURAL SUPPLY	COLD WATER BIOTA	SALMONID SPAWNING	PRIMARY CONTACT RECREATION	SECONDARY CONTACT RECREATION	SPECIAL RESOURCE WATER[a]
	CALDWELL AREA							
SWB 10	Snake River (King Hill-Strike Dam)	*	*	*	(*)	*	*	*
SWB 20	Snake River (Strike Dam-Boise R)	*	*	(*)	(*)	(*)		
SWB 210	Reynolds Creek (Source-mouth)		*	*	*	*	*	
SWB 260	Boise River (Mile 50-Caldwell)		*	*	(*)	*	*	
SWB 271	Ten Mile and Five Mile Creeks (Source-mouth)		*	(*)	(*)		*	
SWB 280	Boise River (Caldwell-mouth)		*	(*)	(*)	*	*	
SWB 282	Indian Creek (Below Sugar Cr, Nampa)		*	(*)		(*)	*	
SWB 30	Snake River (Payette R-Boise R)		*	(*)	(*)	*	*	
SWB 340	Payette River (Black Canyon Dam-mouth)	*	*	*	*	*	*	
SWB 420	Wieser River (Midvale-mouth)		*	(*)	(*)	*	*	
	TWIN FALLS AREA							
USB 520	Raft River (Source-mouth)		*	*	*	*	*	
USB 60A	Snake River (Minidoka Dam-Hey/Bur Br)		*	*	*	*	*	
USB 60B	Snake River (Hey/Bur Br-Milner Dam)		*	(Warm water biota)		*	*	
USB 70	Snake River (Milner Dam-Buhl)		*	*	*	*	*	
USB 730	Rock Creek (Rock Creek City-mouth)		*	*	*	(*)	*	
USB 740	Cedar Draw (Source-mouth)		*	*	*		*	
USB 810	Deep Creek (Source-mouth)		*	*	*		*	
USB 820	Salmon Falls Creek (ID/NV border-mouth)		*	*	*	*	*	
USB 80	Snake River (Buhl-King Hill)		*	*	*	*	*	
USB 850	Big Wood River (Source-Magic Res)	*	*	*	*	*	*	*

Table 2-22. Continued

SEGMENT NUMBER	WATERS	DOMESTIC SUPPLY	AGRICULTURAL SUPPLY	COLD WATER BIOTA	SALMONID SPAWNING	PRIMARY CONTACT RECREATION	SECONDARY CONTACT RECREATION	SPECIAL RESOURCE WATER[a]
USB 871	Little Wood River (Source-Richfield)		*	*	*	*	*	
USB 840	Billingsley Creek (Source-mouth)	*	*	*		*	*	*
			BLACKFOOT AREA					
USB 30	Snake River (Roberts-Am Falls Res)	*	*	*	*	*	*	
USB 40	Snake River (American Falls Res)	*	*	*		*	*	
USB 411	Marsh Creek (Source-mouth)		*	(*)	(*)	(*)	*	
BB 30	Bear River (Soda Sp-UPL Tailrace)		*	*	*	*	*	
BB 410	Mink Creek (Source-mouth)		*	*	*	*	*	
BB 430	Worm Creek (Source-ID/UT border)		*	(*)	(*)	(*)	*	
BB 450A	Cub River (Mapleton-Franklin)		*	*		*	*	
BB 471	Little Malad River (Source-mouth)		*	(*)	(*)	(*)	*	

---

[a] Special Resource Water: Recognized by IDHW as needing intensive protection to (a) preserve outstanding or unique characteristics or (b) to maintain current beneficial use.

* = Protected for general use.

(*) = Protected for future use.

SOURCE: IDHW 1983b.

Table 2-23. Number and Size of Farms Identified by Survey as Correlated to Receiving Water Segment

SEGMENT NUMBER		FARM SIZE <50	51-200	201-700	701-1000	>1000
	Caldwell Survey Area					
SWB 420	Weiser R (Midvale-mouth)					1
SWB 340	Payette R (Black Canyon Dam-mouth)			2	1	
SWB 30	Snake R (Payette R-Boise R)					1
SWB 280	Boise R (Caldwell-mouth)			1		2
SWB 20	Snake R (Strike Dam-Boise R)		1	1		4
SWB 270	Boise R (Mile 50-Vet State Park)	1				
SWB 10	Snake R (King Hill-Strike Dam)	1				2
	Twin Falls Survey Area					
USB 520	Raft R (Source-mouth)		1			
USB 60A	Snake R (Minikoka Dam-Hey/Bur Br)		2			
USB 60B	Snake R (Hey/Bur Br-Milner Dam)		1			
USB 70	Snake R (Milner Dam-Buhl)		1			
USB 730	Rock Cr (Rock Cr City-mouth)	1	1	1		
USB 740	Cedar Draw (Source-mouth)	1	2	1		
USB 810	Deep Cr (Source-mouth)	2	7			
USB 820	Salmon Falls Cr (ID/NV border-mouth)		1	1		
USB 850	Big Wood R (Source-Magic Res)	3	12			1
USB 80	Snake R (Buhl-King Hill)	2	6	1		
USB 871	Little Wood R (Source-Richfield)	2	10			
USB 840	Billingsley Cr (Source-mouth)		1			
	Blackfoot Survey Area					
USB 30	Snake R (Roberts-Am Falls Res)	1			1	
USB 40	Snake R (Am Falls Res)				1	
USB 411	Marsh Cr (Source-mouth)		1			
BB 471	Little Malad R (Source-mouth)	3				
BB 410	Mink Cr (Source-mouth)	2	3			
BB 430	Worm Cr (Source-ID/UT border)	1	3			
BB 450A	Cub R (Mapleton-Franklin)	6	2	1		
BB 30	Bear R (Soda Sp-UPL Tailrace)	7	6	1		

Note: Although 298 operations were identified by the aerial survey, many (particularly in the Twin Falls area) discharge to canals or ditches which appear to have no discharge to creeks or rivers. These operations are omitted from this table.

the area above the aquifer to undergo extensive review for possible impacts on the aquifer. In response to this petition, the Governor's Office requested that instead of federal designation, EPA allow the state to take an active role in aquifer protection. EPA is presently delaying further processing on the Sole Source designation, and the state has agreed to develop an aquifer protection plan that would go beyond the protective mechanism provided by a Sole Source designation. A planning strategy for the groundwater management plan is now in preparation. Initial problem solving and a proposal should be completed by October, 1985. Federal agencies in the area have also voluntarily agreed to submit their projects for review, although the designation is not in effect (Mullen pers. comm.).

Regardless of whether the aquifer eventually receives Sole Source status or whether it is managed under a state protection plan, its significance as a water source should be considered in evaluating activities occurring above it, particularly where underlying lava or other porous formations allow relatively rapid and unfiltered entrance of surface water into the aquifer. The absence of containment facilities in many feedlots and dairies presently causes surfacewater pollution. However, constructing inadequately sealed containment facilities may result in groundwater pollution, particularly by nitrates. Groundwater pollution is generally much more difficult to clean up than surfacewater pollution. In determining the correct management of feedlot and dairy wastes, both surface and groundwater concerns must be considered.

At present, the impact of existing facilities on groundwater has not been quantified, and it is difficult to distinguish the impact of septic tanks and feedlots. It is known that nitrate levels are elevated above background levels, although at least 95 percent of the wells are still below the public health standard of 10 mg/l. Perhaps 70 wells have nitrate levels of 12-15 mg/l (Brower pers. comm.). The aquifer location and groundwater problem areas are shown in Figures 2-7 and 2-8. Both the Rathdrum-Prairie and the proposed Snake River Plain Sole Source aquifer show some evidence of contamination. Septic tanks are the primary cause in the former, and both septic tanks and agricultural wastes are believed to affect the latter. A USGS study is presently underway to determine the extent to which various sources contribute to contamination (Shook pers. comm.).

Priority Sources

A large number of facilities are potential candidates for permits. These include many of the previously permitted facilities (Tables 2-2, 2-7, and 2-12), many of the large operations identified by aerial survey (Tables 2-3, 2-8, and 2-13), and the additional sources identified through complaints or other mechanisms (Tables 2-4 and 2-9).

Previously permitted sources should be considered priorities, particularly those that have received complaints

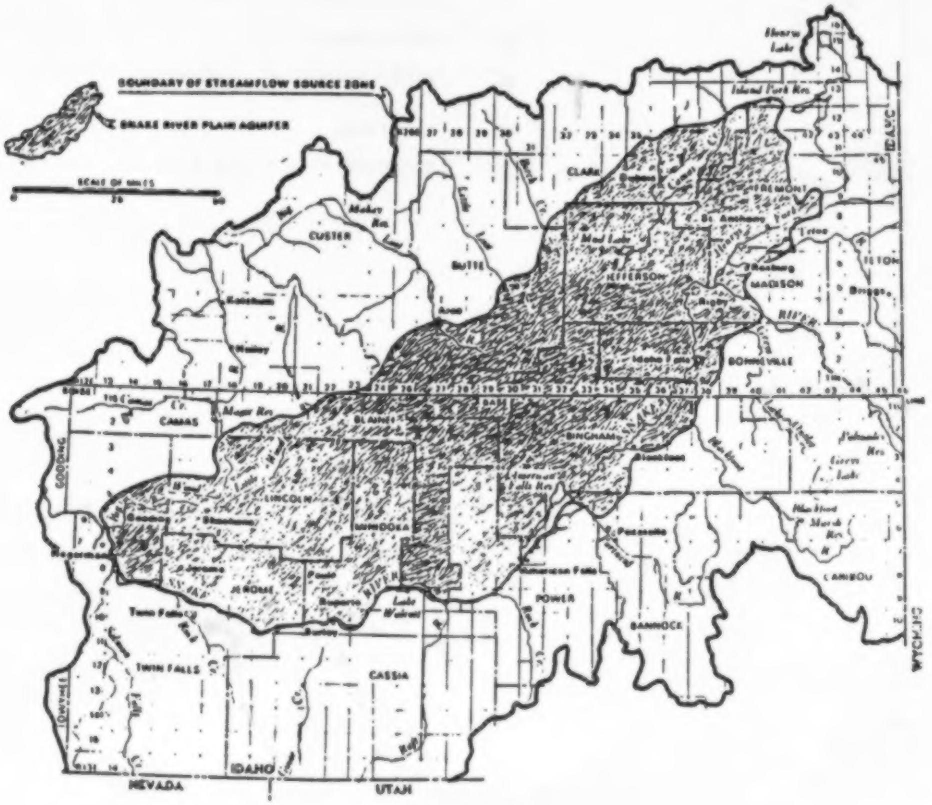

BOUNDARY OF STREAMFLOW SOURCE ZONE
SNAKE RIVER PLAIN AQUIFER
SCALE OF MILES
0
25
50
CUSTER
BUTTE
CLARK
FREMONT
JEFFERSON
MADISON
TETON
BONNEVILLE
CAMAS
GOODING
BLAINE
BINGHAM
LINCOLN
MINIDOKA
JEROME
POWER
BANNOCK
CARIBOU
TWIN FALLS
CASSIA
Island Park Res.
Mackay Res.
Magic Res.
American Falls Res.
Lake Walcott
Palisades Res.
Idaho Falls
American Falls
Pocatello
Twin Falls
Jerome
Rigby
SNAKE
RIVER
IDAHO
NEVADA
UTAH
WYOMING

FIGURE 2-7. LOCATION OF THE SNAKE PLAIN AQUIFER

SOURCE: MULLEN PERS. COMM.

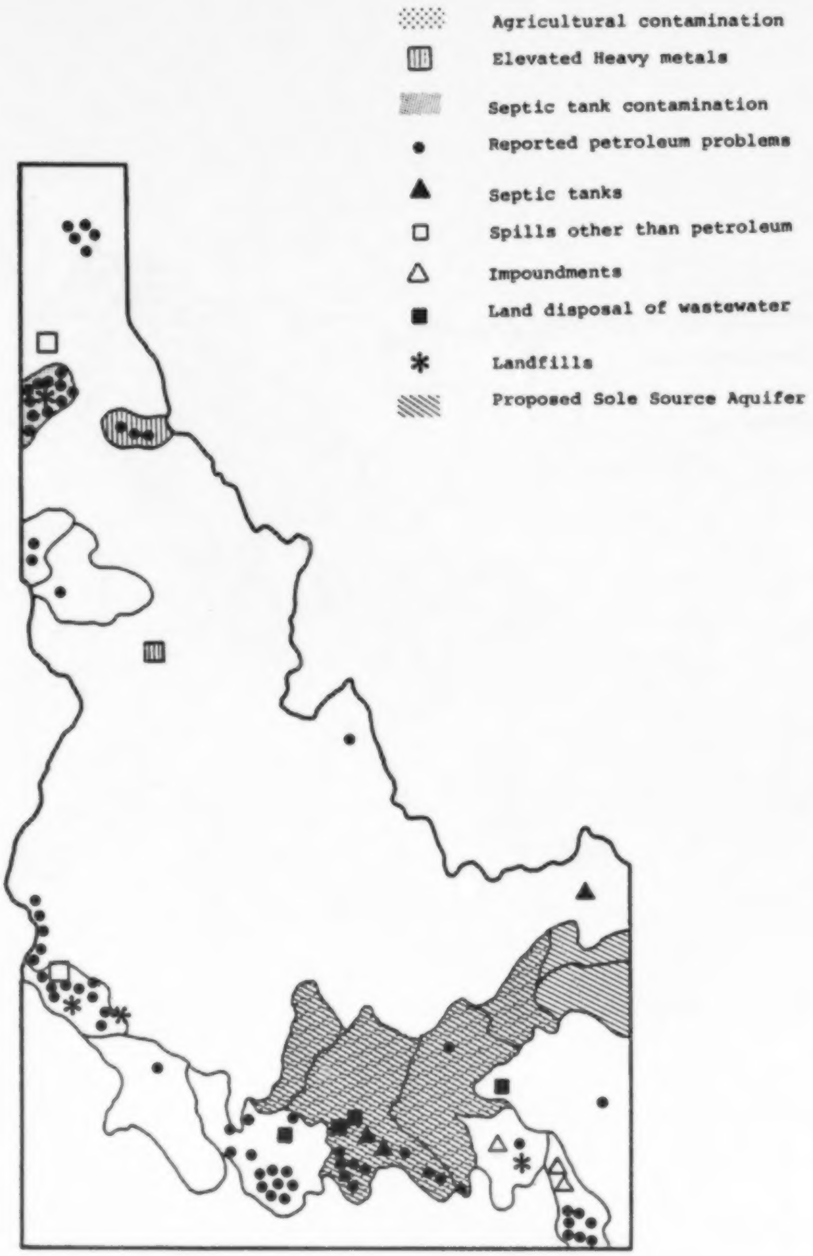

Agricultural contamination
Elevated Heavy metals
Septic tank contamination
Reported petroleum problems
Septic tanks
Spills other than petroleum
Impoundments
Land disposal of wastewater
Landfills
Proposed Sole Source Aquifer

FIGURE 2-8. GROUNDWATER PROBLEM AREAS

SOURCE: ADAPTED FROM IDHW 1984B, SHOOK PERS. COMM.

and/or have no impoundments, such as Bivens Livestock and Bower Feedlot in Caldwell. The status and ownership of the following previously permitted sources should be particularly reassessed, as the operations were not identified in the aerial survey and little is known about their present condition.

Sources to evaluate in the Caldwell area:

- Emmett Feedlot (Emmett)
- Idaho Meat Packers (Caldwell)
- Lone Star Cattle Co. (Nampa)
- P&B Feedlot (Melba)
- R. L. Cattle Co. (Nampa)
- Richard Rutledge Cattle Co. (Caldwell)
- Simplot Livestock (Boise)
- Wilder Cattle Co. (Wilder)
- Higby Cattle Co. (Payette)
- Boise Assoc. Dairies (Boise)
- Dari Vest Farms (Parma)

Sources to evaluate in the Twin Falls area:

- All previously permitted sources (Table 2-7) should be reassessed, as none were identified in the aerial survey.

Sources to evaluate in the Blackfoot area:

- Arnold Feedlot (Idaho Falls)
- Hyer Cattle Company (Shelley)
- Louis Skaar and Sons, Inc. (Roberts)

All sources along the river segments considered high priority by IDHW should also be considered priority sources, regardless of size. Stream segments of concern were identified in the previous section. Sources along these segments can be obtained from Tables 2-3, 2-8, and 2-13. The aerial survey provides some individual information on water pollution potential in terms of size, access, and impoundments, but individual inspections of sources along these key stream segments are needed to really determine individual on-site conditions. Many of these are relatively small sources, but they can be permitted under the regulations because of their water quality impact. The above list is by no means meant to be all-inclusive. It is merely a starting focal point.

Chapter 3

INFLUENCE OF SOILS AND CLIMATE ON IMPOUNDMENT PERFORMANCE

Overview of Study Area Soils

Soils normally have an important relationship to quantity and quality of surface water runoff and runoff impact on adjacent water bodies. The soil type is a major factor in determining the degree to which precipitation will infiltrate or shed as stormwater runoff. Infiltration capacity can be particularly important in sizing of impoundments where runoff is to be contained. In animal confinement areas, however, the relationship between infiltration capacity and soil texture or type tends to be obscured by several factors. Animals compact the soil, and animal manure tends to clog soil pores and seal the surface layer, retarding water infiltration. During much of the winter, frozen ground also prevents infiltration of rain (McCollum pers. comm.). Given the combined effect of these factors on most soils, the majority of water falling on a confined animal feeding area during winter is likely to run off. In conditions where rainfall also results in snowmelt, runoff may even exceed the measured precipitation. In times of unfrozen or unsaturated ground, soils will play a greater role in runoff, particularly if they are sandy soils which allow more rapid infiltration.

Proper facility design requires site-specific knowledge of both surface soils and subsoil. Soil type and texture can vary greatly from place to place within a small area, and several hundred soil types exist within the state. It is not within the scope of this project to discuss all possible site-specific conditions. This section therefore provides a generalized overview of soils expected in the study area, as taken from the general soils maps (USDA 1984a) and selected county soil survey general planning maps for selected parts of the study area.

Idaho soil surveys have not been completed for many geographical areas. Figure 3-1 shows areas where soil surveys are available. Only a limited number of county soil surveys are available in the study area. These include Ada, Gem, Madison, Jefferson, Bonneville, and Bigham Counties and parts of Canyon, Owyhee, Cassia, Minidoka, Blaine, and Lincoln Counties. A generalized state soils map showing major soil subgroups is also available. Because the subgroups are differentiated primarily by formation and development, each subgroup includes all types of textures. This map is of limited value in planning, but it does

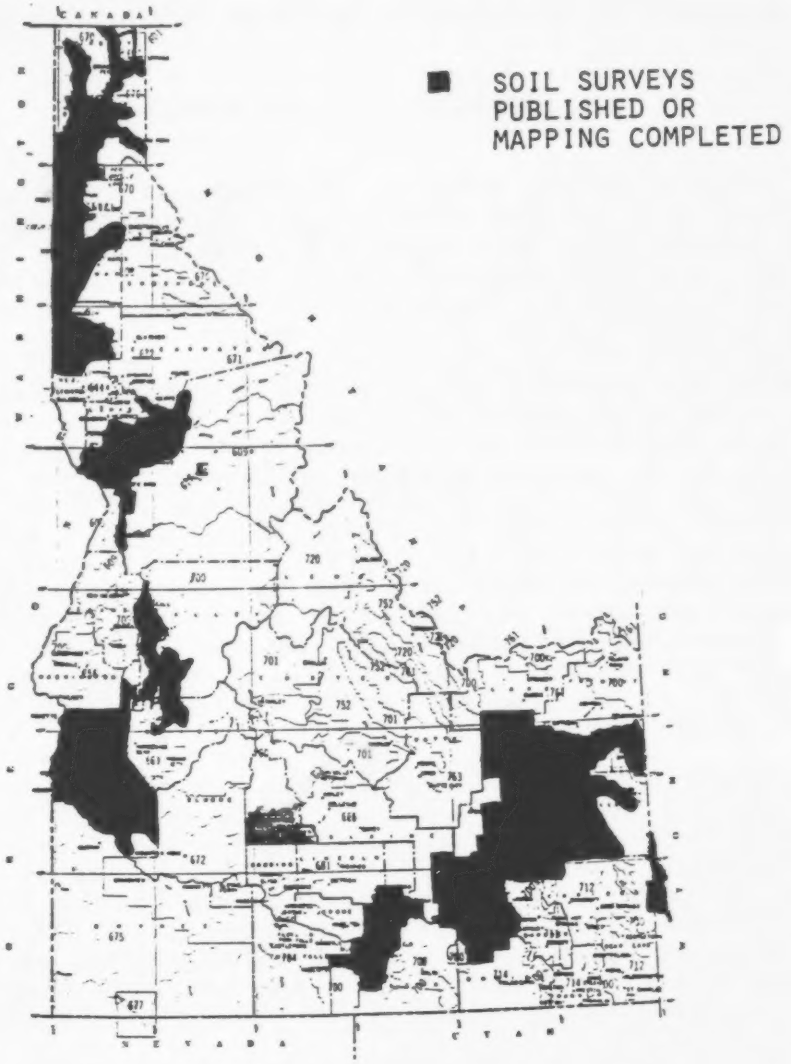

■ SOIL SURVEYS PUBLISHED OR MAPPING COMPLETED
CANADA
NEVADA
UTAH

FIGURE 3-1. STATUS OF IDAHO SOIL SURVEYS

SOURCE: U. S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE 1984B provide some insight into topography and areas expected to support confined animal operations.

The state contains four major landform provinces (Figure 3-2). The fourth province is further subdivided into six sections. The majority of the study area (and the animal feeding operations) lies within two sections of the Columbia Intermontane Province (Eastern Snake River Plain and Malheur-Boise-King Hill sections) and the Basin and Range Province.

The Eastern Snake River Plain section is the largest landform section in the study area, and it covers most of the Twin Falls and Blackfoot areas. It is a lava-filled basin about 60 miles wide, generally following the Snake River and extending from near the Montana border to the western boundary of Twin Falls County. The major soil groups in this section are Aridisols (light-colored soils found in areas of low precipitation), Mollisols (dark-surfaced soils, often with high amounts of organic materials, found beneath grass), and Entisols (relatively immature soils which lack horizons and have remained in place only for short periods). The main parent material sources for soils in this area include: 1) Quaternary deposits (alluvium [river deposits], basin fill, outwash, floodplain and terrace gravels, loess, lacustrine [lake] and glacial deposits, and some active sand dunes); and 2) lava deposits and basalt flows (USDA 1984a).

This section contains the State's only area of xeric mesic Vertisols, located in the northern half of Gooding and Lincoln Counties. These soils are dominated by swelling clays. The majority of dairies lie to the south of this area.

The region to the south of Blackfoot, which includes the Bear Lake Basin, contains large areas of Mollisols. This area is primarily a mixture of cold soils on mountains formed in Quartzite, rhyolite, and limestone residuum, colluvium (heterogeneous deposits), and alluvium with some volcanic influence; cold soils on mountains formed in loess and in residuum and alluvium from sandstone, limestone, and shale; and soils on plateaus formed in loess, silty alluvium, and some volcanic ash.

In the Blackfoot vicinity, soils in the northwest Bingham area (lying to the north and west of Moreland and Springfield) are primarily a Pancheri-Polatis association. These soils are found on basalt plains, are well drained, deep and moderately deep, nearly level to moderately sloping, and have a medium-textured surface layer. The Declo-Fingal association occurs in the Springfield and Aberdeen areas. These soils are found on lake terraces, are nearly level to strongly sloping, deep, well and moderately well drained, and have a medium- or moderately-coarse textured surface layer (USDA 1973). Many dairies are located in these areas.

Landform Provinces

1	Northern Rocky Mountain Province - extends over most of central Idaho and is characterized by high, mature mountains and deep intermontane valleys.
2	Middle Rocky Mountain Province - typified by two landforms: (1) the heavily forested Yellowstone Plateau of volcanic origin, and (2) the complexly folded and faulted ranges on the extreme southeastern corner.
3	Basin and Range Province - characterized by sub-parallel, block-faulted mountains separated by open valleys.
4	Columbia Intermontane Province - characterized by complex structure, nearly horizontal sheets of basalt, and block-fault mountains.
4A	Eastern Snake River Plain section - a lava-filled structural and topographic basin about 60 miles wide.
4B	Malheur-Boise-King Hill Section - characterized by thick lacustrine and fluviatile sediments that are extensively interbedded with basalt flows.
4C	Owyhee Uplands Section - a high plateau (5000 feet) of older lavas, lower elevation deserts, and some higher mountains (8000 feet).
4D	Seven Devils Section - an elevated mountainous mass cut by the deep canyons of the Snake and Salmon Rivers.
4E	Tri-State Upland Section - a gently undulating plateau of 3000 to 5000 feet elevation, underlain by Columbia River basalt flows.
4F	Palouse Hills Section - rolling, asymmetrical hills that commonly rise 20 to 80 feet.

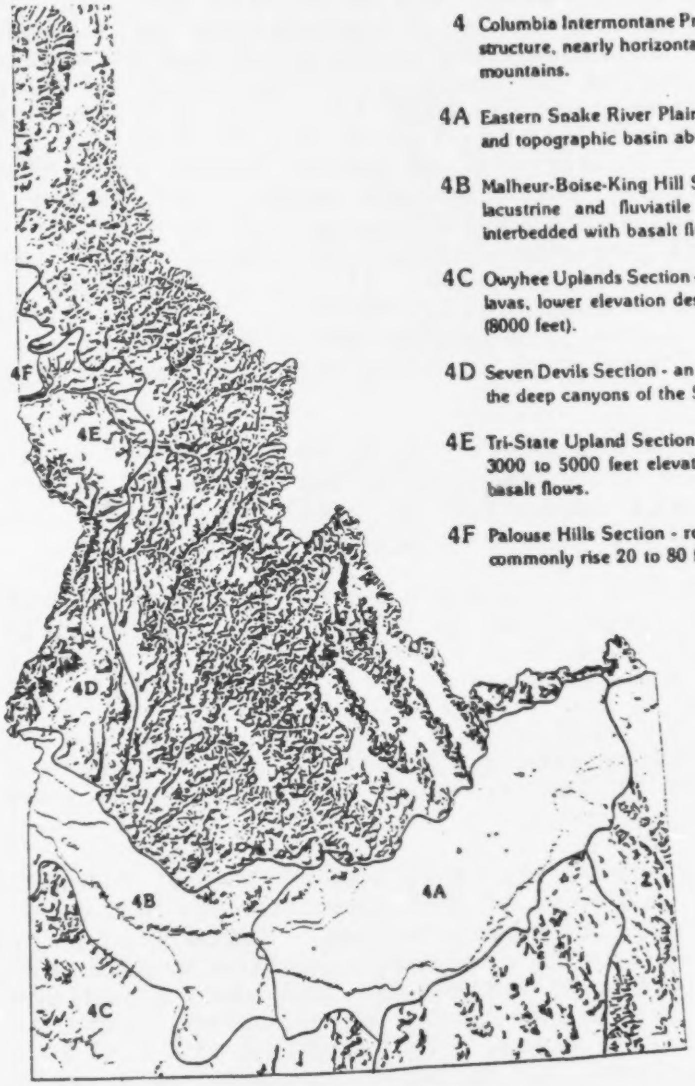


FIGURE 3-2. MAJOR LANDFORM PROVINCES OF IDAHO

SOURCE: USDA 1984A

Moreland and Blackfoot are located in the Bannock-Bock association, which is characterized by nearly level to moderately sloping, well drained deep soils having a medium-textured surface layer. The Bingham soil survey does not indicate suitability for sewage lagoon use, but most soils in this area have 40 or more inches of moderately permeable soil over basalt (Poncheri and Polatis) or gravel (Bannock and Bock). Fingal soils have a water table less than 4 feet from the surface.

No soil surveys are yet available for the Twin Falls-Jerome-Wendell area. The closest areas surveyed are western Cassia County and Minidoka County. Because soils vary so greatly from area to area, it is unwise to extrapolate data from one area to another. However, soils in the Twin Falls area are known to be approximately 75-80 percent Portneuf silt loam about 40 inches deep. This soil is well drained, has 0-2 percent slopes, and is moderately permeable. In the Wendell area, where most of the dairies are concentrated, the surface layer is more sandy, and infiltration is more rapid (McCollum pers. comm.).

The Basin and Range Province, the second landform province, is located from the Snake River floodplain south to the Utah border, and from the Blackfoot reservoir west to approximately Heyburn. It covers the southern portion of the Blackfoot study area to the west of Bear Lake. This area is characterized by sub-parallel block-faulted mountains separated by open valleys. Major parent material sources for this area include: 1) basalts; outwash, floodplain, and terrace gravels; lacustrine, eolian, and glacial surficial cover; till, moraines, and shoreline deposits; 2) volcanics, welded tuff, ash, and flow rock; 3) granitic plutons; and 4) marine and clastic sediments and dolomitic limestone (USDA 1984a). No individual soil surveys have been completed for this area.

The Malheur-Boise-King Hill section, the third landform area, covers most of the Caldwell study area. It includes lowlands on both sides of the Snake River from the Oregon border to approximately the west end of Twin Falls County, plus lower portions of the Boise and Payette Rivers and much of the Bruneau River Basin. This area is characterized by thick lacustrine and fluviatile sediments extensively interbedded with basalt flows. Major soils groups include Aridisols, Entisols, and Mollisols. Major parent material sources for this area include: 1) outwash, floodplain, and terrace deposits; lava-dammed silt and clay beds; alluvium; a small sand dune area; and 2) basalt flows, welded tuff, ash, and granitic plutons. In the Caldwell area, soils on low terraces and floodplains along the lower Boise and lower Payette Rivers are characterized as aquic mesic Aridisols formed in recent alluvium.

In the Boise area of Ada County, soils along the Boise River on floodplains and drainageways are primarily Notus, Moulton, and Falk series. These are poorly drained, nearly level, and very deep soils. Soils found along creeks, such as Tenmile and Indian Creeks, include Power, Aeric Haplaquepts, and Jenness. These soils are nearly level to sloping, both poorly and well drained, and very deep. The majority of the soils in the remainder of Ada County, in areas such as Meridian and Orchard, are well drained and moderate to very deep. Prevalent associations include the Tenmile-Chilcott-Kunaton (level to very steep, well drained, shallow to deep, gravelly, silt and silt clay loams); the Chilcott-Kunaton-Sebree association (nearly level to sloping, well drained, shallow, and moderately deep) both found on basalt plains and high alluvial terraces; the Power-McCain-Purdam association (well drained, nearly level to sloping, moderately and very deep soils) found on basalt plains and low alluvial terraces; and several others (USDA 1980). The SCS rates a large proportion of these as "severe" in terms of sewage lagoon use. Many have wetness or seepage problems (including Aeric Haplaquepts, Power, Notus, Moulton, and Falk soils) or a cemented hardpan (Chilcott, Kunaton, Sebree, and Purdam).

A bit to the east at Caldwell, Canyon County soils along creeks and rivers and at Nampa are primarily the Moulton-Brom-Baldock association. These are somewhat poorly drained and moderately well drained, fine, sandy-to-silt loams in lowlands. On lake terraces and alluvial fans of Wilder and Marsing, the Greenleaf-Nyssaton-Garbutt association of well-drained silt loams occurs. In Sunnyslope and along both sides of the Snake River, the Turbyfill-Cencove-Feltham association is most prevalent. These soils are well drained and somewhat excessively drained, fine, sandy loams located on fans and terraces. They are generally rated "moderate" or "severe" in terms of use for sewage lagoons. Many, such as Moulton, are permeable; others like Nyssaton or Feltham, have moderate to steep slopes. Still others, such as Baldock, have a seasonal high water table at a depth of 3-4 feet. Most are rated as "good" for agricultural drainage, as many are sloping or sandy.

Overview of Study Area Climate

The climate of the study area has a significant influence on the water resources of the study area in terms of stream flow, groundwater recharge, stormwater runoff, and surface water quality.

The study area is a semi-arid region that is dependent on irrigation water from surface and groundwater sources. The Snake River and its tributaries, as well as extensive groundwater reserves, have enabled agriculture to become widely established in spite of the dry climate.

Occasional rainstorms and seasonal snowmelt can cause substantial runoff and can be a causative factor in the discharge of manure-laden water from feedlot and dairy yards, and in the overflow of impoundments in both types of operations. Proper feedlot and dairy facility design requires an understanding of the climatic influences on the design and operation of these facilities.

For the purposes of this report, the study area climate can be characterized by the selected precipitation and temperature data shown in Tables 3-1, 3-2, and 3-3 and by the 10-year, 24-hour and 25-year, 24-hour precipitation isopluvial maps shown in Figures 3-3 and 3-4.

The western area, as represented by Boise, is the most temperate portion of the study area. It is influenced by air masses from the Pacific as well as atmospheric developments from other directions. A mild upland continental type of climate occurs in summer, tempered by cloudy or stormy but mild temperature winters. Average temperatures vary widely from year to year, yet day-to-day changes are comparatively small for an inland area.

Summer hot periods seldom last more than a few days; maximum temperatures exceed 100°F an average of three times a year. Cold periods tend to last longer: in January 1949, Boise had 16 days with minimum temperatures of 0° or lower.

Precipitation falls mostly as rain, although from November to April a significant portion may fall as snow. November through May constitutes the wettest portion of the year; summers are relatively dry. Within the study area, precipitation may increase substantially in foothill and mountain areas due to the orographic effects of the terrain. Most of the dairies and feedlots covered in this study are in the river valley areas. The precipitation data in Table 3-2 are representative of conditions found in the valleys.

Moving eastward through the study area, elevations increase from 2,100 feet at the Oregon border to 2,700 feet at Boise, 3,700 feet at Twin Falls, and 4,500 feet at Pocatello and Blackfoot. The climate grows cooler and loses some of the tempering offered by Pacific air masses. A comparison of averge monthly minimum temperatures for Boise, Twin Falls, and Pocatello illustrates this well (Table 3-1). Average dates for last and first frosts are May 6 and October 12 for Boise, and May 4 and October 5 for Pocatello. Mean precipitation decreases into the Twin Falls area and then increases slightly near Pocatello. The proportion of precipitation falling as snow increases markedly at Pocatello, reflecting the cooler temperatures. A frost depth of 1-2 feet is common in the winter.

Climatic Influences on Runoff

Both single and chronic rainfall events can wash accumulated manure from feedlots and dairy yards and cause overflow of impoundments. Snowmelt, especially combined with a warm spring rain or even average rainfall on frozen ground, can also cause manure-laden water to run from feedlots and dairies into streams, canals, or adjacent properties. It is necessary to quantify the likelihood and duration of the events that can cause these

Table 3-1. Selected Temperature Data for Southern Idaho

BOISE AREA

	Averages, °F			# of Days	
	Monthly	Daily Max	Daily Min	Max Temp 32° and Below	Min Temp 32° and Below
Jan	29.9	37.1	22.6	10	26
Feb	36.1	44.3	27.9	3	21
Mar	41.4	51.8	30.9	*	18
Apr	48.6	60.8	36.4	0	8
May	57.4	70.8	44.0	0	2
Jun	65.8	79.8	51.8	0	0
Jul	74.6	90.6	58.5	0	0
Aug	72.0	87.3	56.7	0	0
Sept	63.2	77.6	48.7	0	*
Oct	51.9	64.6	39.1	0	5
Nov	39.7	49.0	30.5	1	18
Dec	32.0	39.3	24.6	6	25
Average Year				19	123

TWIN FALLS AREA

	Averages, °F			# of Days	
	Monthly	Daily Max	Daily Min	Max Temp 32° and Below	Min Temp 32° and Below
Jan	29.4	38.2	20.6	7	27
Feb	34.4	44.2	24.6	3	24
Mar	39.3	51.1	27.4	0	24
Apr	47.6	61.1	34.0	0	13
May	57.0	71.5	42.4	0	2
June	64.5	79.8	49.1	0	0
July	72.7	90.4	55.0	0	0
Aug	70.4	88.1	52.7	0	0
Sept	60.5	77.6	43.4	0	2
Oct	50.0	65.5	34.6	0	12
Nov	38.8	49.9	27.7	1	22
Dec	30.8	39.5	22.0	6	28
Average Year				17	154

POCATELLO AREA

	Averages, °F			# of Days	
	Monthly	Daily Max	Daily Min	Max Temp 32° and Below	Min Temp 32° and Below
Jan	23.8	32.4	15.1	13	27
Feb	29.5	38.6	20.4	7	25
Mar	35.5	45.8	25.2	2	26
Apr	44.6	56.8	32.3	*	17
May	54.0	67.7	40.3	0	5
June	62.5	77.6	47.3	0	*
July	71.2	88.6	53.8	0	0
Aug	68.9	86.0	51.7	0	*
Sept	59.2	75.7	42.7	0	3
Oct	48.1	62.8	33.3	*	15
Nov	35.2	45.6	24.8	4	23
Dec	26.6	35.3	17.9	12	27
Average Year				38	169

---

* Less than one-half

SOURCE: NOAA 1983a, b, and 1976

Table 3-2. Selected Precipitation Data for Southern Idaho

BOISE AREA

	Water Equivalent, inches			Snowfall, inches		
	Monthly Average	Max Month	24 Hr Record	Monthly Average	Max Month	24 Hr Record
Jan	1.64	3.87	1.48	7.3	21.4	8.5
Feb	1.07	2.62	1.00	3.7	25.2	13.0
Mar	1.03	2.76	1.65	1.9	11.9	6.4
Apr	1.19	3.04	1.27	0.7	8.0	7.2
May	1.21	4.00	1.51	0.1	4.0	4.0
Jun	0.95	3.41	2.24	T	T	T
Jul	0.26	1.62	0.94	T	T	T
Aug	0.40	2.37	1.61	0.0	0.0	0.0
Sep	0.58	2.54	1.74	0.0	0.0	0.0
Oct	0.75	2.25	0.76	0.1	2.7	1.7
Nov	1.29	2.44	0.88	1.9	8.8	6.5
Dec	1.34	4.23	1.16	5.8	26.2	6.7
Average Year	11.71			21.5		

TWIN FALLS AREA

	Water Equivalent, inches			Snowfall, inches		
	Monthly Average	Max Month	24 Hr Record	Monthly Average	Max Month	24 Hr Record
Jan	1.14	3.22	0.85	5.7	17.1	8.0
Feb	0.73	1.86	0.75	2.8	15.0	5.0
Mar	0.79	1.59	1.27	2.3	12.5	9.0
Apr	0.84	2.35	1.05	0.8	4.5	2.0
May	1.06	2.92	1.42	0.5	5.0	2.0
Jun	0.96	2.82	0.88	0.0	0.0	0.0
Jul	0.21	0.56	0.54	0.0	0.0	0.0
Aug	0.35	2.77	0.87	0.0	0.0	0.0
Sep	0.47	2.33	0.65	0.0	0.0	0.0
Oct	0.62	2.46	0.98	0.3	3.0	1.0
Nov	0.98	2.27	0.78	1.3	7.0	3.0
Dec	1.14	3.89	1.21	4.9	16.0	9.0
Average Year	9.29			18.6		

POCATELLO AREA

	Water Equivalent, inches			Snowfall, inches		
	Monthly Average	Max Month	24 Hr Record	Monthly Average	Max Month	24 Hr Record
Jan	1.13	3.24	0.97	10.2	28.1	10.1
Feb	0.86	1.51	0.67	5.7	16.3	6.1
Mar	0.94	2.95	0.90	5.8	15.4	7.3
Apr	1.16	3.30	1.25	4.4	15.5	10.0
May	1.20	3.29	1.67	0.5	5.5	5.2
Jun	1.06	3.30	1.08	T	0.2	0.2
Jul	0.47	1.84	0.98	0.0	0.0	0.0
Aug	0.60	3.98	1.16	0.0	0.0	0.0
Sep	0.65	3.43	1.13	0.1	2.0	2.0
Oct	0.92	2.56	1.82	1.9	12.6	8.0
Nov	0.91	2.84	0.85	4.3	11.5	6.8
Dec	0.96	3.39	0.94	8.9	33.7	9.5
Average Year	10.86			41.8		

T = Trace

SOURCE: NOAA 1983a, b, and 1976

Table 3-3. Climatological Data Comparisons

	Temperature Data								
	Averages , °F						# Days		
	Boise Monthly	Twin Falls Monthly	Pocatello Monthly	Boise Daily Min	Twin Falls Daily Min	Pocatello Daily Min	Boise Min Temp 32° and Below	Twin Falls Min Temp 32° and Below	Pocatello Min Temp 32° and Below
Jan	29.9	29.4	23.8	22.6	20.6	15.1	26	27	27
Feb	36.1	34.4	29.5	27.9	24.6	20.4	21	24	25
Mar	41.4	39.3	35.5	30.9	27.4	25.2	18	24	26
Apr	48.6	47.6	44.6	36.4	34.0	32.3	8	13	17
May	57.4	57.0	54.0	44.0	42.4	40.3	2	2	5
June	65.8	64.5	62.5	51.8	49.1	47.3	0	0	*
July	74.6	72.7	71.2	58.5	55.0	53.8	0	0	0
Aug	72.0	70.4	68.9	56.7	52.7	51.7	0	0	*
Sept	63.2	60.5	59.2	48.7	43.4	42.7	*	2	3
Oct	51.9	50.0	48.1	39.1	34.6	33.3	5	12	15
Nov	39.7	38.8	35.2	30.5	27.7	24.8	18	22	23
Dec	32.0	30.8	26.6	24.6	22.0	17.9	25	28	27
Year							123	154	169

	Precipitation Data					
	Water Equivalent (inches)			Snowfall (inches)		
	Boise Monthly Average	Twin Falls Monthly Average	Pocatello Monthly Average	Boise Monthly Average	Twin Falls Monthly Average	Pocatello Monthly Average
Jan	1.64	1.14	1.13	7.3	5.7	10.2
Feb	1.07	0.73	0.86	3.7	2.8	5.7
Mar	1.03	0.79	0.94	1.9	2.3	5.8
Apr	1.19	0.84	1.16	0.7	0.8	4.4
May	1.21	1.06	1.20	0.1	0.5	0.5
June	0.95	0.96	1.06	T	0.0	T
July	0.26	0.21	0.47	T	0.0	0.0
Aug	0.40	0.35	0.60	0.0	0.0	0.0
Sept	0.58	0.47	0.65	0.0	0.0	0.1
Oct	0.75	0.62	0.92	0.1	0.3	1.9
Nov	1.29	0.98	0.91	1.9	1.3	4.3
Dec	1.34	1.14	0.96	5.8	4.9	8.9
Year	11.71	9.29	10.86	21.5	18.6	41.8

---

* Less than one-half

T Trace

SOURCE: NOAA 1983a, b, and 1976

discharges in order to develop adequate criteria for design and operation of impoundments.

The various relevant climatic factors include:

- rainfall duration, intensity, and cumulative total;
- antecedent conditions, including presence of frozen ground, accumulated snow, or thawed but saturated soil;
- temperature, particularly as related to potential for snowmelt or thaw condition; and
- evaporation of rain or accumulated snow.

Operational factors specific to the feedlots and dairies that inter-relate with these factors include the level of wastes in impoundments, the ability of fields to accept waste deposition, and the routes for surface drainage within the operation.

Past impoundment designs have been based on retention of the expected runoff from a 10-year (or 25-year), 24-hour rainfall event: that is, the amount of rainfall within 24 hours that is likely to be exceeded on the average only once in 10 years (or once in 25 years). The National Oceanic and Atmospheric Administration (NOAA 1973) has published isopluvial maps for such events for Idaho showing the rainfall in tenths of an inch, as shown in Figures 3-3 and 3-4. For a 10-year frequency, 24-hour rainfall event, about 2 inches would be expected at Boise, 1.4 inches at Twin Falls, and 1.8 inches at Pocatello. For the 25-year, 24-hour rainfall event, Boise could expect 2.4 inches, Twin Falls 1.8 inches, and Pocatello 2.1 inches. Because most impoundment designs have assumed infiltration of the rainfall would occur, actual storage capacity is normally much less than the actual expected event. This is discussed further in Chapter 4.

In Idaho, cumulative precipitation is especially important during winter. Impoundments cannot be pumped out onto fields because manure-laden water cannot be incorporated into the frozen soil. Temperature data indicate there is a 2-3 month period in Boise and Twin Falls (around December and January) and a 3-4 month period in Pocatello-Blackfoot area (around December through February) that may be expected to have frozen ground. Normal precipitation would total about 4 inches for a 3-month period in Boise and for the same 4-month period in Pocatello.

During this period, some evaporation would occur, particularly where precipitation remains as snow. However, a year with heavy precipitation could deposit a substantial quantity of snow which remains as a progressively-accumulating reservoir of "latent runoff" during the winter. In 1983, for example, a total of 5.63 inches of precipitation fell from January through March at Boise.

Maximum month precipitation ranges up to 4.23 inches at Boise, 3.89 inches at Twin Falls, and 3.98 inches at Pocatello. During January, which has the lowest minimum temperatures and the greatest likelihood of frozen ground, maximum monthly precipitation of 3.2-3.9 inches can occur at each of the locations. Thus, it can be seen that precipitation and snowmelt conditions in the study area could easily combine to cause runoff exceeding that from a 25-year, 24-hour rainfall event even without an intense 24-hour rainfall.

In designing for the volume of precipitation that facilities should be able to retain without discharge, several factors should be considered including: impermeability of frozen ground, maximum month precipitation near the end of winter, accumulated snow from prior months, evaporation, and thaw conditions resulting in runoff of essentially all of the stored water with little or no percolation. This suggests a runoff of at least 2-4 inches, depending on location and on how the factors are applied.

To evaluate long-term retention requirements for containment facilities, precipitation data for Boise were analyzed to identify the average cumulative rainfall for 3- and 4-month periods during winter when runoff retention would be required. These months also encompass the months having the highest number of complaints (December-May). Forty years of records (1944-1984) were examined and cumulative precipitation for various monthly groupings was determined from Boise rainfall data. Results are shown in Table 3-4. The average cumulative rainfall for 3- and 4-month periods averages around 3-4 inches and 5 inches, respectively.

Evaporation will reduce the amount of precipitation that accumulates on the ground or is stored in retention ponds. The evaporation rate varies greatly on a seasonal basis. Using an average annual evaporation rate when designing impoundments can produce unrealistic results because most of the evaporation data are for irrigation months, which have high evaporation rates. Winter months, when runoff storage is required, tend to have much lower evaporation rates.

Evaporation data for winter months in southern Idaho were sought unsuccessfully. Evaporation pans freeze in winter, so data are not recorded. Because irrigators are the main users of evaporation data, and because there is no irrigation in winter, there has been little public demand for winter determinations.

Evaporation data for winter months were available for the Fall River Mills station in northern California, an area similar to southern Idaho in elevation, latitude, and climate. Summer evaporation data for Idaho do not vary greatly from the summer data at Fall River Mills; this is an indication that winter data for the two areas are also likely to be similar. The evaporation data for Fall River Mills are also consistant with literature

Table 3-4. Cumulative 3- and 4-Month Precipitation at Boise, Idaho (1944-1983)

	3-Month Totals						4-Month Totals				
	Oct-Dec	Nov-Jan	Dec-Feb	Jan-Mar	Feb-Apr	Mar-May	Oct-Jan	Nov-Feb	Dec-Mar	Jan-Apr	Feb-May
1944	3.12										
1945	4.37	3.78	4.35	5.02	4.40	4.44	4.21	5.95	6.11	5.49	6.61
1946	4.02	5.12	4.92	4.35	3.33	2.57	5.74	6.43	6.59	4.70	3.88
1947	4.11	3.41	1.80	2.78	2.80	3.38	4.52	3.85	3.64	3.30	3.82
1948	3.81	2.74	3.05	3.81	4.37	3.70	4.92	4.32	4.47	5.18	5.28
1949	3.28	3.25	4.28	2.65	2.62	1.30	3.93	5.30	4.76	2.74	3.35
1950	4.14	4.61	4.30	5.63	3.65	3.83	5.81	5.70	6.31	6.18	4.92
1951	5.87	5.38	6.01	4.87	4.15	2.93	5.80	7.54	7.06	5.81	5.09
1952	1.35	5.51	4.83	4.41	4.25	4.21	7.11	6.63	6.88	5.49	5.33
1953	2.57	4.70	5.84	5.76	3.93	5.03	4.70	6.19	6.76	7.28	6.52
1954	2.47	3.55	2.79	2.84	2.17	2.57	3.66	4.10	3.99	3.26	3.12
1955	4.39	3.35	2.84	2.14	3.86	4.91	3.79	3.78	3.23	5.18	5.34
1956	3.50	5.82	5.30	3.47	2.92	4.19	6.56	6.73	5.69	5.09	5.10
1957	3.31	2.29	3.60	5.03	5.14	6.21	4.54	4.01	5.87	6.18	7.93
1958	2.41	4.26	5.36	3.85	4.42	4.56	4.68	6.17	5.93	5.79	6.47
1959	1.65	3.65	3.24	3.04	1.90	2.95	3.74	4.28	4.32	3.23	3.58
1960	2.74	2.22	3.60	4.46	3.56	3.03	2.98	3.96	4.99	4.89	4.77
1961	3.61	2.67	2.05	3.01	2.81	2.15	3.16	3.87	3.44	3.23	3.35
1962	3.14	2.85	2.67	3.04	2.96	5.09	4.61	3.62	3.94	3.96	5.86
1963	4.42	3.05	3.08	3.04	3.56	2.71	4.27	4.75	3.29	4.69	4.41
1964	5.73	5.89	3.67	3.29	2.18	3.75	6.88	6.08	4.31	4.64	3.94
1965	2.40	8.41	6.39	3.63	3.55	4.04	8.62	8.72	6.82	6.44	4.35
1966	3.30	2.93	2.15	2.14	1.94	1.53	3.21	3.66	2.75	2.75	2.26
1967	1.81	4.50	3.25	2.21	2.19	2.33	4.79	4.85	3.62	3.68	2.68
1968	4.15	1.82	2.79	3.00	2.92	1.46	2.24	3.68	3.50	3.35	3.32
1969	3.00	6.95	6.45	4.76	2.61	2.11	7.65	7.95	6.71	6.11	3.11
1970	4.21	6.23	5.94	5.21	2.27	2.70	6.87	6.53	6.98	6.14	3.00
1971	4.48	5.44	4.06	4.19	2.55	2.15	6.25	6.09	5.56	4.59	2.80
1972	3.54	6.10	4.69	4.56	3.03	2.44	6.63	7.01	6.19	5.18	3.35
1973	5.82	4.04	3.35	2.21	2.56	2.88	4.68	4.46	4.00	3.70	3.30
1974	3.83	6.02	4.24	3.51	2.83	2.27	7.17	6.68	5.74	4.18	2.93
1975	4.06	2.97	4.92	5.13	6.07	4.33	4.42	5.59	6.84	6.66	6.95
1976	0.75	3.56	4.09	3.52	3.63	2.78	5.55	4.87	4.81	5.12	4.09
1977	4.53	0.88	1.31	2.08	1.62	2.85	1.40	1.45	2.17	2.27	3.42
1978	1.66	6.69	6.33	5.30	5.27	4.13	6.90	8.19	7.76	7.64	5.63
1979	3.54	3.59	3.73	3.61	3.28	3.36	3.59	4.79	4.21	5.21	4.56
1980	3.05	3.60	3.59	4.99	4.63	7.11	5.10	4.89	5.73	6.19	8.40
1981	5.93	3.95	3.71	4.98	5.71	5.64	4.25	4.97	6.47	6.91	6.66
1982	4.76	6.38	5.68	4.35	3.72	2.57	7.35	7.92	7.07	5.14	4.11
1983	6.66	4.69	4.85	5.63	6.25	6.92	6.43	5.95	7.55	7.92	8.18

	3-Month Totals						4-Month Totals				
	Oct-Dec	Nov-Jan	Dec-Feb	Jan-Mar	Feb-Apr	Mar-May	Oct-Jan	Nov-Feb	Dec-Mar	Jan-Apr	Feb-May
Number:	40	39	39	39	39	39	39	39	39	39	39
Average:	3.64	4.28	4.08	3.88	3.48	3.52	5.10	5.42	5.28	5.01	4.66
Min:	0.75	0.88	1.31	2.08	1.62	1.30	1.40	1.45	2.17	2.27	2.26
Max:	6.66	8.41	6.45	5.76	6.25	7.11	8.62	8.72	7.76	7.92	8.40
Std Dev:	1.30	1.59	1.32	1.09	1.15	1.40	1.59	1.54	1.48	1.40	1.59
Var:	1.68	2.52	1.74	1.20	1.31	1.96	2.52	2.36	2.18	1.95	2.53

estimates of 1-2 inches of evaporation (technically sublimation) per month from snowpack (Meinzer 1942).

Evaporation rate is determined by the surface area available for liquid or ice crystals to convert to water vapor, as well as by a wide range of climatic factors including temperature, relative humidity, and wind velocity. In winter, rain and melting snow will have less opportunity to infiltrate the soil because of frozen ground. Most water will run off and be collected in an impoundment, where the evaporation will be limited to the relatively small surface area of the pond. If precipitation remains on the corral area as snow, it will sublime from the entire watershed area. Trampling and compaction of snow, and waste deposition by animals, will reduce evaporation to some degree and may also hasten thawing.

All of these processes are complex and difficult to predict numerically. A simplified approach to determining evaporation of snow during 3- and 4-month winter periods was attempted because evaporation from snowpack will reduce the amount of water ultimately requiring retention. This evalaution assumes that in winter a high percentage of precipitation will fall as snow; as such, this precipitation has a greater opportunity for evaporation than it would have if concentrated in an impoundment as runoff. An "evaporation opportunity" factor, expressed as a percent of the expected precipitation, was estimated for each winter month, based on temperature data and assumed probability of precipitation falling as snow in a given month. These estimated evaporation opportunity values are shown in Table 3-5.

The net water available for runoff from snowmelt for the previously described cumulative 3- and 4-month periods was then estimated by multiplying the assumed pan evaporation data times the evaporation opportunity factor and subtracting this product from the historic monthly rainfall values. The 39 complete years of record were adjusted for evaporation to determine the number of inches of precipitation available as runoff. Appendix Table A-1 shows the precipitation values adjusted by month on a yearly basis. Table 3-6 summarizes the results of this analysis in terms of 3- and 4-month cumulative precipitation. It can be seen from Table 3-6 that 3-month cumulative precipitation adjusted for evaporation ranges from 1-1.6 inches, depending on the period evaluated. Cumulative 4-month totals range around 2 inches. Table 3-7 contrasts average cumulative precipitation with the precipitation adjusted to reflect estimated evaporation.

Relationship of Complaints to Precipitation

Complaint records were reviewed to identify possible correlations between complaints and precipitation. Between January 1, 1979, and March 31, 1984, a total of 107 complaints involving wastewater or manure discharges were tabulated. Fly, odor, and dust complaints were excluded. Fifty-seven complaints

Table 3-6. Precipitation Adjusted for Evaporation Using Fall River Mills Rates and Evaporation Opportunity Factors

	3-Month Totals						4-Month Totals				
	Oct-Dec	Nov-Jan	Dec-Feb	Jan-Mar	Feb-Apr	Mar-May	Oct-Jan	Nov-Feb	Dec-Mar	Jan-Apr	Feb-May
1944	0.82										
1945	1.90	0.82	1.34	1.75	1.75	2.28	0.82	1.94	1.98	1.75	3.39
1946	1.56	2.12	1.87	1.04	0.80	0.55	2.14	2.37	2.42	1.04	0.80
1947	1.85	1.05	0.00	0.72	0.72	1.17	1.56	1.05	0.72	0.72	1.17
1948	1.34	0.27	0.52	0.82	1.37	1.18	1.85	0.79	0.82	1.37	1.71
1949	1.00	1.26	2.24	0.99	0.99	0.16	1.34	2.26	2.24	0.99	1.15
1950	1.85	1.79	1.43	2.32	0.92	1.59	2.39	1.83	2.32	2.32	1.62
1951	3.40	2.38	2.96	1.63	1.22	0.48	2.38	3.48	2.96	1.75	1.59
1952	0.14	2.51	1.78	1.10	1.25	1.69	3.51	2.57	2.71	1.36	1.76
1953	0.59	2.35	2.79	2.65	1.13	2.71	2.35	2.79	2.79	3.35	3.15
1954	0.23	0.59	0.29	0.08	0.08	0.46	0.59	0.59	0.37	0.08	0.46
1955	1.92	0.41	0.41	0.19	2.22	3.12	0.41	0.41	0.41	2.40	3.12
1956	1.65	2.82	2.39	1.04	0.80	2.40	2.96	2.82	2.39	1.83	2.40
1957	1.22	0.00	0.66	1.81	2.14	3.69	1.65	0.66	1.81	2.14	4.36
1958	0.45	1.45	2.31	1.09	1.97	2.59	1.45	2.31	2.31	2.21	3.45
1959	0.16	0.65	0.61	0.20	0.00	1.11	0.65	0.65	0.61	0.20	1.11
1960	0.82	0.20	0.88	1.15	0.95	0.91	0.35	0.88	1.15	1.15	1.59
1961	1.19	0.82	0.14	0.41	0.41	0.27	0.82	0.96	0.41	0.41	0.41
1962	1.29	0.04	0.04	0.15	0.25	2.57	1.19	0.04	0.19	0.25	2.57
1963	1.95	0.67	0.64	0.64	1.47	1.10	1.29	1.31	0.64	1.47	1.75
1964	3.65	2.89	1.48	1.33	0.53	1.71	3.28	2.89	1.48	1.85	1.71
1965	0.51	5.41	4.08	1.76	1.99	2.21	5.41	5.41	4.08	3.74	2.21
1966	1.14	0.51	0.00	0.00	0.00	0.00	0.51	0.51	0.00	0.00	0.00
1967	0.00	1.50	0.90	0.36	0.65	0.65	1.50	1.50	0.90	1.00	0.65
1968	1.68	0.00	0.80	0.80	0.80	0.00	0.00	0.80	0.80	0.80	0.80
1969	0.94	3.95	3.45	2.37	0.53	0.53	4.05	3.95	3.45	2.89	0.53
1970	1.74	3.64	3.64	2.74	0.11	0.26	3.68	3.64	3.64	2.84	0.26
1971	2.08	2.44	1.41	1.29	0.38	0.38	2.65	2.44	1.79	1.29	0.38
1972	1.07	3.10	1.78	1.40	0.38	0.38	3.10	3.10	2.16	1.40	0.38
1973	3.35	1.04	0.93	0.01	0.67	0.83	1.08	1.04	0.93	0.67	0.83
1974	1.69	3.02	1.58	0.60	0.38	0.38	3.57	3.02	1.96	0.60	0.38
1975	1.81	0.85	2.41	2.36	3.07	1.81	1.69	2.41	3.21	3.07	3.38
1976	0.00	0.78	1.04	0.61	1.03	0.78	2.17	1.04	1.04	1.39	1.03
1977	2.45	0.00	0.00	0.00	0.00	1.23	0.00	0.00	0.00	0.00	1.23
1978	0.06	3.69	3.28	1.99	2.27	1.83	3.69	4.13	3.59	3.51	2.27
1979	1.20	0.85	0.94	0.94	0.92	1.48	0.85	1.00	0.94	1.72	1.63
1980	0.88	0.72	0.66	1.68	1.63	4.59	1.62	0.96	1.68	2.06	4.83
1981	3.46	0.95	0.69	1.71	2.75	3.12	0.95	0.95	2.33	2.81	3.12
1982	2.29	3.38	2.63	1.04	0.75	0.27	3.75	3.86	2.90	1.04	0.75
1983	4.23	1.69	1.80	2.32	3.25	4.40	2.83	1.89	3.38	3.79	4.61

	3-Month Totals						4-Month Totals				
	OctDec	Nov-Jan	Dec-Feb	Jan-Mar	Feb-Apr	Mar-May	Oct-Jan	Nov-Feb	Dec-Mar	Jan-Apr	Feb-May
Number:	40	39	39	39	39	39	39	39	39	39	39
Average:	1.49	1.61	1.46	1.16	1.09	1.46	1.95	1.90	1.78	1.62	1.76
Min:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max:	4.23	5.41	4.08	2.74	3.25	4.59	5.41	5.41	4.08	3.79	4.83
Std Dev:	1.05	1.30	1.09	0.78	0.84	1.19	1.27	1.28	1.13	1.05	1.27
Var:	1.10	1.70	1.19	0.61	0.70	1.42	1.60	1.63	1.27	1.10	1.61

Table 3-5. Estimated Evaporation Rates and Evaporation Opportunity Factors

EVAPORATION RATES[a]

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1.26	1.51	2.8	4.12	5.72	7.07	8.61	7.74	5.38	3.01	1.67	1.08	49.97

ESTIMATED EVAPORATION OPPORTUNITY FACTORS[b]

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0.9	0.7	0.4	0.2	0.1	0	0	0	0	0.2	0.6	0.8

---

[a] Inches of evaporation for Fall River Mills, CA (Lat. 41°21', Long. 121°49' and elevation 3,348 ft).

[b] Based on temperature data and the estimated probability of precipitation remaining on the ground as snow.

Table 3-7. Cumulative Precipitation and Net Precipitation Adjusted for Evaporation for 3-Month and 4-Month Wet Seasons at Boise, Idaho

	CUMULATIVE PRECIPITATION[a]	
	AVERAGE 3-MONTH PERIOD	AVERAGE 4-MONTH PERIOD
Minimum	0.75	1.40
Maximum	8.41	8.72
Average	3.81	5.09
80th Percentile[b]	4.95	6.60

	NET PRECIPITATION ADJUSTED FOR EVAPORATION	
	AVERAGE 3-MONTH PERIOD	AVERAGE 4-MONTH PERIOD
Minimum	0	0
Maximum	5.41	5.41
Average	1.37	1.80
80th Percentile[b]	2.29	3.03

---

[a] Averages derived from Table 3-4.

[b] Represents a 1-in-5-year winter.

originated in the Twin Falls area, 49 in the Caldwell area, and 1 in Pocatello. The complaints were distributed by month as shown in Table 3-8.

In reviewing daily rainfall records for the complaint period, only two rainfall events in Boise were of sufficient magnitude to approach or exceed the 10-year, 24-hour rainfall events: August 13, 1979 (1.61 inches), preceded the day before by 0.01 inches and followed the day after by 0.04 inches) and April 30-May 1, 1983, when 2.02 inches fell in a 48-hour period. No complaints were recorded during the 3 weeks following either of these storms. For 1983, this is surprising, as antecedant rainfall had been heavy: 6.5 inches and 4.9 inches for the preceding 120- and 90-day periods. Reasons for the lack of complaints following these storms are not clear. Possibly the high volume of runoff from the entire watershed diluted the flows and reduced visibility of the discharges, or local recognition of the unusual conditions led to tacit acceptance of discharges under such conditions. Perhaps many impoundments were also newly emptied in April before the storm.

A comparison of complaint dates with corresponding daily rainfall data shows complaints are often generated on days having only small amounts of precipitation. The records reveal no correlation between complaints and high intensity storms measured at Boise. Although existing impoundment design criteria emphasize the 10-year or 25-year, 24-hour rainfall events, recorded complaints do not immediately follow intense storms. The highest rainfall volume recorded on the day of a complaint was 0.50 inches, and the highest for a day prior to a complaint was 0.66 inches. These are significantly less than the 10-year or 25-year, 24-hour rainfall events, which both exceed 2 inches. Because impoundments cannot be emptied after each rainfall event, cumulative rainfall would be expected to have a greater impact on discharges than single rainfall events.

To determine the impact of cumulative precipitation and also to obtain some idea of the necessary holding period from the complaint perspective (as opposed to the holding requirements imposed by frozen ground), daily rainfall for the period of record was tabulated together with cumulative rainfall for periods of 7, 30, 90, and 120 days prior to (but excluding) the complaint date. The number of complaints preceded by above-average rainfall conditions for each of the periods is shown in Table 3-9. Tables for the individual periods are provided in Appendix A, Tables A-2 through A-5. The strongest correlations between complaints and antecedant rainfall exist for the 90- and 120-day rainfall periods. The period of record for this analysis was short (5 years); and in all of the years except 1979, rainfall was above average. Thus, the results of Table 3-9 may not be statistically significant. Nevertheless, these tabulations and comparisons support the development of design criteria for cumulative (3-4 months) rainfall retention rather than short-term (24-hour), single-event retention period.

Table 3-8. Monthly Distribution of Feedlot and Dairy Complaints[a] Received in Boise and Twin Falls (January, 1979 - March, 1984)

MONTH	NUMBER OF COMPLAINTS
Jan	9
Feb	19
Mar	20
Apr	19
May	9
Jun	8
Jul	1
Aug	2
Sep	2
Oct	2
Nov	5
Dec	11
Total	107

---

[a] Does not include odor or dust complaints.

Table 3-9. Number of Complaints with Antecedent Rainfall Exceeding Average Rainfall

PERIOD	AVERAGE RAINFALL FOR PERIOD	NUMBER OF COMPLAINTS[a]
7 days	0.30 in.	47
30 days	1.29 in.	55
90 days	3.85 in.	68
120 days	5.09 in.	71

---

[a] From a total of 107 tabulated complaints.

Chapter 4

BEST MANAGEMENT PRACTICES AND DESIGN CRITERIA

BMPs Effective in Water Pollution Abatement

A comprehensive surfacewater pollution abatement strategy should focus on three areas: eliminating or regulating animal access to water; reducing, eliminating or controlling release of wastes and stormwater runoff into surface waters; and minimizing overland transport of land-applied wastes. Both water pollution regulations and abatement strategies tend to focus primarily on impoundments, as opposed to reducing animal access or runoff of land-applied manure from fields. Land application of wastes is indirectly related to containment facility design, however. Because climatic factors prevent manure application on fields during winter, there is a need to size impoundments to accomodate waste storage during this period.

A number of existing manuals describe BMPs that can reduce water pollution from confined animal operations. All BMPs will not be applicable to each operation, and the use of any particular BMP will depend on site-specific conditions. A few general BMPs, taken primarily from ODA (1982), are discussed briefly below.

Fencing

Installation or relocation of fences can be used to decrease water pollution in several ways. Fences can:

- prevent animals from trampling streambanks and entering surface waters;
- restrict animals from flooded areas;
- provide a space between the lot and surfacewater for runoff interception and storage;
- provide an area for waste treatment facilities; and
- decrease the lot area, thus reducing runoff volume.

Runoff Diversion

Constructing facilities to intercept and divert runoff water from adjacent areas before it can enter a confinement area will reduce the required storage volume. Diversion can be accomplished by:

- relocating waterways that flow through the lot;
- constructing berms, ditches, or other barriers above the lot to intercept runoff from adjacent areas;
- installing gutters and downspouts to intercept roof runoff; and
- installing water bars, cattle guards, or other facilities to intercept runoff flowing down roadways.

Reducing Runoff Volume

In addition to water diversion, runoff volume, and therefore storage volume, can be reduced in several ways, including:

- roofing various areas, particularly manure piles or feeding areas, to exclude precipitation;
- improving the lot surface to allow support of a denser animal population and reduction of the lot area;
- minimizing water use for cooling and cleaning or flushing manure; and
- reusing milking parlor washwater for washing stalls.

Reducing Land-Application Impacts

Reducing pollutant transport from land-applied wastes can be accomplished by:

- applying at a time when the soil is able to absorb most, if not all, of the liquid portions so runoff is unlikely to occur;
- applying immediately prior to soil incorporation;
- using vegetated buffer strips along field edges;
- using practices that minimize soil erosion;
- applying at a rate that will not harm plants but will allow maximum soil absorption;
- installing water-tight pipe crossings over streams when piping to manure guns;
- converting open ditches to subsurface drains to minimize runoff transport to watercourses; and

- installing a tailwater pump-back facility if wastes are distributed via a surface irrigation system.

Existing BMP Utilization and Effectiveness

A large number of existing manuals describe BMPs for both operation and maintenance of animal waste containment facilities. The degree to which these practices are used varies a great deal, however, depending on individual farmer knowledge and concern, site-specific conditions, the degree of farmer interaction with SCS or other agencies, and the degree of detail and specificity of any waste facility plans which have been prepared.

Contacting individual farmers to determine site-specific use of BMPs is beyond the scope of this project. It is possible, however, to provide a general overview of the types of practices which are being recommended and some indications as to their use by reviewing facility plans and talking to agency personnel. The aerial survey also provides some very limited information on BMP use, primarily by indicating the presence or absence of fencing and impoundments. As BAT and BPT require containment of effluent amd runoff, a lack of compliance can be assumed if no impoundments are present. The converse is not true however; if impoundments are present, compliance with BPT or BAT cannot be assumed because the photos do not indicate the depth of the impoundments and the containment volume can therefore not be calculated.

It was hoped that facilities plans would provide information on BMPs, but very few facility plans were available even for permitted operations. EPA permit files contained none, and compliance files contained only one dairy facility plan and no plans for feedlot facilities. SCS files contain a number of small dairy facility plans, but the SCS is reluctant to allow release of plans because they contain confidential information. In addition, in many areas the emphasis on design of facility plans for feedlots and dairies has decreased over the last few years; few recent plans are available. The IDHW Boise office files contained no plans of any kind. The IDHW Twin Falls office had no plans of permitted facilities and few for other facilities. A number of dairy plans for nonpermitted operations were found in the IDHW Pocatello office files, but all were developed in 1980 or earlier and none were for permitted facilities.

A review of some of the more substantial plans, although they are not recent and probably not a representative sample, provides an indication of the variability of BMPs in use. Table 4-1 summarizes and contrasts the contents of seven of the more detailed dairy plans obtained from IDHW and SCS files. The plans were reviewed for three types of information that would relate to management practices: problem identification and background

Table 4-1. Comparison of Dairy Waste Management Plans

	Problem Assessment Contents								Waste System Contents									Waste Utilization Contents					
	GROUNDWATER CONTAMINATION	SURFACEWATER CONTAMINATION	AIR POLLUTION	OFF-SITE DRAINAGE	SLOPES	SOILS	CROPS	FUTURE EXPANSION	WASTE TYPE	WASTE VOLUME	RUNOFF VOLUME	HOLDING TIME	EMPTYING PROCEDURE	SOLIDS HANDLING	ANIMAL CONTAINMENT PERIOD	NUMBER OF ANIMALS	IMPOUNDMENT VOLUME	APPLICATION RATE	APPLICATION TIME	APPLICATION LOCATION	APPLICATION PROCEDURE	METHOD OF INCORPORATION	NUTRIENT CONTENT
Plan 1 1980 (Pocatello Dairy)	-	-	x	x	x	x	x	x	x	-	-	4 mo.	3 times/ yr.	x	-	185	(Area-no depth)	-	As weather permits	x	Liquid spread.	Disc	-
Plan 2 1979 (Pocatello Dairy)	-	x	x	x	x	x	x	x	-	-	-	4 mo.	Pumped to sprinkler	x	Nov. - June	30	-	x	May - Sept.	x	Dil./ irrg.	Irrg.	x
Plan 3 1977 (Pocatello Dairy)	x	x	-	-	x	x	x	x	x	x	x	3 mo.	Pump to irrg. ditch	x	Winter	65	x	x	-	x	-	-	x
Plan 4 No date (Pocatello Dairy)	-	x	x	x	x	x	x	x	x	-	-	5 mo.	Pump to irrg. ditch	x	7-8 mo.	60	-	x	In favor. weather	x	-	-	x
Plan 5[a] 1980 (Pocatello Dairy)						x			-	x				x		160		x	Between cuttings	x	-	-	x
Plan 6 1980 (Pocatello Hogs)	-	-	x	-	-	-	x	-	x	x	-	4 mo.	Pump to honey wagon	-	-	72	-	x	-	x	-	-	x
Plan 7 1982 (Twin Falls Dairy)	x	x	-	-	x	x	-	-	x	x	x	3 mo. (Dec. 15 - Mar. 15)	-	x	-	150	37,500 ft^3	-	None after fall period	-	Slurry spread.	-	-

---

x Topic covered or alluded to in some fashion.

- No indication topic was considered.

[a] Some plan pages missing.

information, waste management system details, and waste utilization. If a plan contained any reference, however oblique or inadequate, to a particular topic, the topic was considered to be a part of the plan.

Because so few plans were available, the plans compared in Table 4-1 should not be considered representative of all dairies, but the comparison does bring out several interesting points. For one thing, the plans varied widely in content and detail. In problem assessment statements, only two of the seven plans mentioned anything that could indicate groundwater contamination was ever considered. Only three plans contained comments related to the possibility of offsite drainage, and only two contained reference (either positive or negative) to potential impacts on surfacewater. Six plans mentioned soil types; five mentioned crops or acreage; and four made reference to air pollution, winds, or other odor-related factors.

In describing the waste management system, all but one plan mentioned a holding period (periods varied from 3-5 months); but only one (the most sophisticated) specified expected months of the holding period, and a fall date by which the pond should be empty. All plans mentioned the number of animals, but only two indicated rainfall runoff contribution and waste pit volumes, and only four included waste volume calculations.

In describing waste utilization practices, the application rate, location, timing, and nutrient content of the manure were rather consistently mentioned; application procedures and method of waste incorporation into the soil were mentioned only in three cases. In both the problem assessment and waste practices, greater emphasis appeared to be placed on air pollution and manure utilization than on water pollution control, as evidenced by less detail concerning manure containment at the dairy or after field application.

The aerial photos indicate that a large percentage of dairies and feedlots have not constructed impoundments of any kind. Only 32 percent of the dairies (62 of the 193 surveyed) and 21 percent of the feedlots (22 of 104 surveyed) show evidence of impoundments. The degree of BAT implementation on operations having impoundments is unknown. No plans are available in the files, and the aerial survey indicates only surface area of the impoundments, not depth. Without the ability to calculate impoundment volume, use of BPT or BAT cannot be confirmed unless individual follow up of these facilities is made. This is beyond the scope of this work. However, the presence of any impoundment, regardless of volume, indicates some degree of wastewater awareness; these farmers may be using various BMPs in other areas of feedlot management as well. In addition to lack of impoundments, approximately 38 percent of the operations in the aerial survey do not restrict animal access to water (see Chapter 2).

It cannot be assumed that management practices not described in a plan are not being used by the farmer. Conversely, describing practices in a plan does not necessarily ensure their implementation. But it can probably be assumed that if a practice is not specified in a plan, there is less chance of its implementation. The first step in effective water pollution control, irrespective of the permit system used, is ensuring farmer awareness by development of waste management plans that provide specific BMPs in the form of operation and maintenance guidelines. In the final analysis, proper operation of an undersized facility will likely outweigh the benefits of a correctly designed facility that is never pumped or maintained.

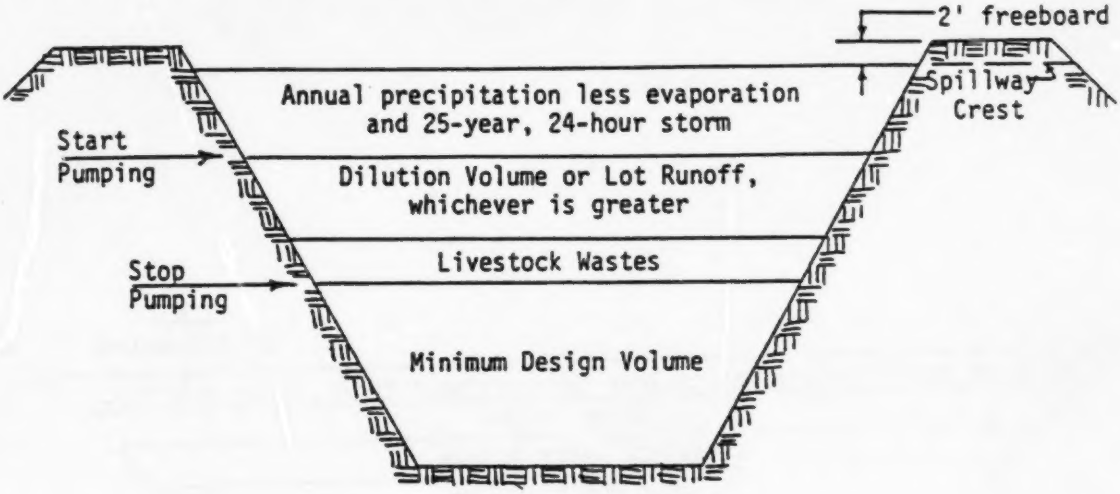
The intent of a management plan should not be to establish control over each detail of the farmer's operation. Rather, it should be used to help build farmer awareness of water quality factors in his operation and to provide him with operational guidance when questions arise. If appropriate management practices are described in a site-specific plan, there is a much greater chance that they will be used when needed.

Existing System Design Criteria

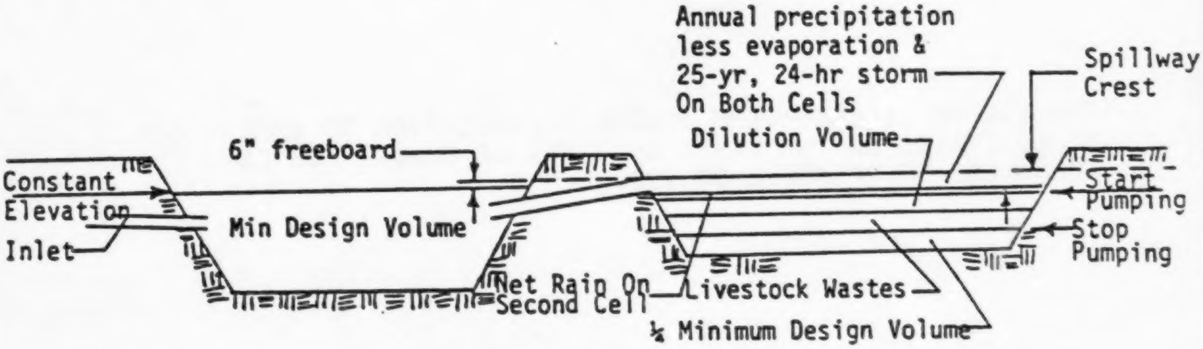
Many feedlots and dairies in Idaho currently experience periodic wastewater containment problems. These problems are intensified when spring thaw follows a heavy winter snowfall. Containment systems, when present, generally consist of a pond or pit at the lower end of a feedlot, allowing drainage water to enter by gravity flow. Many systems have been designed by the SCS as well as by IDHW personnel and private contractors. Although the SCS is generally considered a major source of expertise, the Twin Falls IDHW estimated that only 10 percent of the systems present in 1981 were SCS-designed (Renk 1981). This is likely to be equally true today as well. The SCS will not design for commercial operations, yet these operations, because of their size and number, constitute the main problems. The Twin Falls IDHW has therefore assisted in designing a number of facilities. Other IDHW offices appear less active in design work, although all have been involved to some degree.

Systems may be aerobic or anaerobic. Generalized anaerobic and aerobic facilities are shown in Figures 4-1 and 4-2. Aerobic ponds are simple to operate and maintain. Summer warm spells and resulting difficulties in maintaining oxygen levels are the greatest problem. Frequently, a system is adequate for 11 months per year but not for hot periods in July or August when wastes decompose rapidly and oxygen is depleted.

Typical anaerobic farm ponds are not covered. The result is often odors, scum buildup, and a generally unappealing appearance. Recently, new designs have been tested that provide anaerobic ponds with a floating cover and recover methane gas for use in boilers for process water heating or in engine generators for power generation. Usually, the anaerobic pond is followed by


2' freeboard
Spillway
Crest
Annual precipitation less evaporation
and 25-year, 24-hour storm
Start
Pumping
Dilution Volume or Lot Runoff,
whichever is greater
Livestock Wastes
Stop
Pumping
Minimum Design Volume

Single Cell - Anaerobic Lagoon


Annual precipitation
less evaporation &
25-yr, 24-hr storm
On Both Cells
Spillway
Crest
Dilution Volume
6" freeboard
Constant
Elevation
Inlet
Min Design Volume
Start
Pumping
Stop
Pumping
Net Rain On
Second Cell
Livestock Wastes
½ Minimum Design Volume

Do not count net rain on second stage as part of dilution volume.

STAGE I

Treatment

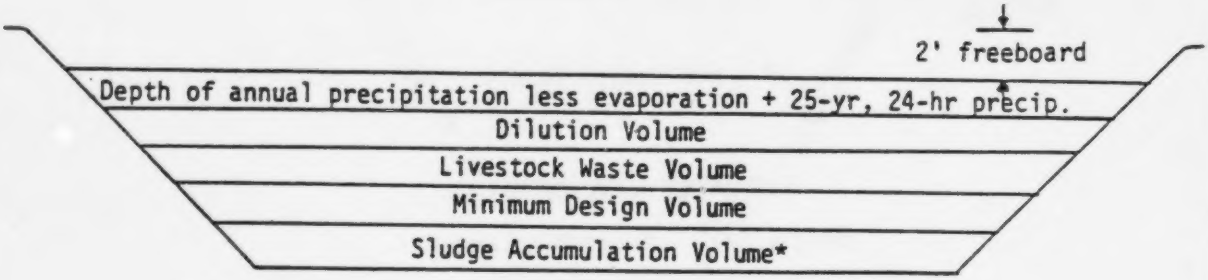
STAGE II

Storage & Treatment

Twin Cell - Anaerobic Lagoon

FIGURE 4-1. GENERALIZED DIAGRAM OF SINGLE- AND TWIN-CELL ANAEROBIC LAGOON SYSTEM

SOURCE: ODA 1982.


2' freeboard
Depth of annual precipitation less evaporation + 25-yr, 24-hr precip.
Dilution Volume
Livestock Waste Volume
Minimum Design Volume
Sludge Accumulation Volume*

*THE VOLUME OF LONG-TERM SLUDGE ACCUMULATION TO EXPECT CAN BE ESTIMATED ON THE BASIS OF 1 FT^3 OF SLUDGE FOR EACH 20 TO 30 LBS OF VOLATILE SOLIDS.

FIGURE 4-2. GENERALIZED DIAGRAM OF AN AEROBIC LAGOON SYSTEM

SOURCE: ODA 1982.

an aerobic pond for aeration prior to disposal. The benefits of such a system often justify the additional cost. Ideal temperatures for anaerobic systems are 95-98°F; reactions are slowed with the decreasing temperatures. Cold winters will affect use of this system in Idaho, although if warm washdown water enters the pond, the cold temperature can be offset somewhat.

Waste containment facilities should be sized to contain animal wastes, process wastes, and runoff. Wastes from feedlot operations are similar to those from dairies, except that dairies have additional daily wastewater from the milking operation. Individual dairy waste volumes vary considerably depending on the mechanics of the individual operation and on whether they sell grade A or grade B milk; grade A dairies have more stringent cleanliness standards, which increase water use. Even within grade A or grade B dairies, washing procedures vary significantly. Daily waste volume will also vary depending on whether milking is done two or three times per day.

The number of animals, animal waste volumes, and total yard area are also important factors in determining both dairy and feedlot waste volume. In beef feedlots, the volume of waste produced per animal depends on animal size. An animal's weight may almost double from start to finished animal. Sheep feedlots are similar to beef feedlots, although waste values per animal differ somewhat.

In considering runoff, confined feedlots or poultry-housing waste ponds are the easiest to design. They also require less containment volume since there is no runoff flow into the pond (assuming that gutters and downspouts are provided to prevent roof drainage from entering the pond).

Files of previously permitted facilities that have received complaints were reviewed to determine the required design criteria and actual facility construction specifications. Effluent limitations information in the files indicated most older systems were required to design for a 10-year, 24-hour storm, although there were some exceptions noted. The Simplot (Grandview) permit allowed discharge for precipitation events greater than 1.0 inch in 24 hours, and the Simplot No. 2 permit allowed discharge for precipitation events greater than 1.5 inches. Permit limitations for the Rutledge, Johnson, Idaho, Emmett, Bower, and Bivens feedlots and the Vanderway Dairy were all listed as requiring design for a 2-inch storm.

With one exception, the files contained no design criteria for any of the permitted facilities. It was therefore not possible to determine actual pond design volumes or dimensions short of conducting actual site visits, a task outside the scope of this project. The aerial survey indicates that, although the permits required containment facilities, many facilities were never constructed. As mentioned previously, only 45% of the permitted facilities and only 28% of the total operations surveyed had impoundments of any type. Where impoundments do exist, in many cases, their adequacy is questionable.

Two major factors related to containment functioning and/or enforcement were noted. First, the regulations allow for discharges in "chronic" and "catastrophic" conditions. As the regulations do not define these conditions, instituting legal enforcement measures against discharging facilities becomes difficult. These conditions have been interpreted differently by different people and in different areas, and the lack of a clear-cut definition provides a loophole for many discharges. For example, 1979 correspondence in the EPA compliance files for Idaho Feedlot Co. (Eagle) states that the "Idaho Feedlot Co. considers snow and ice to qualify as a catastrophic event." As these conditions are commonplace in Idaho, Idaho Feedlot Co.'s assumption seems inadequate to meet the intent of the regulations.

Some states, including Montana and Utah, consider a "chronic" event to occur whenever the cumulative rainfall within a 15-day period exceeds the rainfall expected for a 25-year, 24-hour storm (Hildon, Schuman pers. comm.). This definition is a somewhat more realistic approach, as it acknowledges the cumulative nature of the rainfall problem; but as most farmers need to hold runoff for at least a 4-month period, use of this definition would result in nearly continuous "chronic discharges." If design criteria address the cumulative nature of runoff, and emphasis is placed on construction of approved facilities, there will be little need for EPA to define a chronic and catastrophic condition for enforcement purposes. Any facility built to design criteria should, by definition, meet normal conditions.

The assumptions made in calculating the percent of runoff are a second factor related to impoundment effectiveness. A number of factors including slope, soil characteristics, infiltration, and other characteristics are normally used in determining expected runoff. In the past, design calculations for runoff have sometimes assumed a nearly 50 percent infiltration. In the Boise area, for example, design for a 2-inch rainfall has often assumed a runoff of approximately 0.9 inches. Because much of the precipitation falls in winter when the ground is frozen, normal runoff values are not appropriate. When considering the sealing and compaction that also occur in feedlots, it should be assumed that little infiltration is possible during winter. Using an unrealistic infiltration rate that does not take these factors into account will result in an inadequately sized facility.

There has been some debate regarding design for a 10-year, 24-hour storm versus a 25-year, 24-hour storm, but the difference between these storms is generally less than 0.4 inches. Neighboring states and the EPA guidelines presently require design for a 25-year storm event.

Based on plan review and discussions with IDHW engineers, SCS personnel, and others, existing systems appear to be adequately designed for animal wastes but are often overloaded due to rainfall/snowmelt runoff or excess solids accumulation in the pond. As discussed previously in Chapter 3, containment areas often cannot be pumped out in winter. Cumulative rainfall of several days or weeks often routinely exceeds the volume expected from a single 25-year, 24-hour storm event. As a result, a 25-year, 24-hour design volume is inadequate to prevent overflow of containment structures even when such a storm does not occur. Recently IDHW designs in the Twin Falls area have addressed runoff by including capacity for a period of normal winter rainfall (or snow equivalent) plus a 25-year, 24-hour storm (Burkett pers. comm.). This represents a storage of about 3 inches for the Twin Falls area. Even this number may be an underestimate because the SCS runoff numbers do not account for frozen ground (which should be treated almost like a paved surface). Three to four inches is perhaps a better number for the Twin Falls area (Burkett pers. comm.). SCS designed systems have focused on 25-year storm events and have not included normal winter rainfall.

The analyses in Chapter 3 (Table 3-7) estimate 3 inches represent approximately an 80th percentile (5-year winter) value for precipitation runoff from frozen ground over a 4-month period, with 5.4 inches as the maximum expected value. These estimates incorporate the evaporation assumptions described in Chapter 3 and include no infiltration allowance, because of the potential for frozen ground. Designs accomodating runoff expected from the 5-year winter would need to allow storage for about 3 inches of runoff, with the once in 10-year winter requiring about 3.6 inches. A 1-in-5 yr winter was chosen instead of an average winter because precipation would be expected to exceed that of an average winter one out of every two winters, thus resulting in frequent discharges. A 1-in-5 yr winter would not prevent all overflows but would perform adequately under most conditions without posing unduly large storage requirements.

Another approach to runoff storage has been proposed by the U. S. Army Corps of Engineers. This approach determines storage based on a 25-year frequency, wet-winter period. Runoff from the 25-year winter can be expected to total about 4 inches, assuming Boise precipitation rates, a 4-month retention period, and the methodology described in Chapter 3 for estimating evaporation losses. Under these criteria, the winters of 1979-80 and 1982-83 equalled or exceeded the 25-year winter. The 1982-83 period included the April 30-May 1, 1983 storm when 2.02 inches of rain fell within 2 days at Boise.

The evaluations presented earlier in this chapter address the volume of precipitation that must be retained during the cold months when the ground may be frozen and land application of manure-laden runoff is not possible. The volume of runoff has been numerically approached by estimating precipitation, evaporation, and percolation. The evaluations tend to focus on a net runoff value near 4 inches. This value approximates a 5-year winter plus a 25-year, 24-hour rainfall event and also approximates the 25-year winter. A net 4-inch storage is also consistent with observations on pond effectiveness in the Twin Falls area (Burkett pers. comm.).

Recommended Design Criteria

This section discusses only criteria for sizing containment ponds. Design criteria for treatment and ultimate disposal are described in other references and are not necessary for the purpose of this report.

Based on the aerial survey, the average Idaho dairy contains between 50 and 200 animals, including milkers, dry cows, bull(s), and replacement heifers. The average dairy cowyard area is approximately 6 acres. Feedlots appear to be either relatively small or quite large, with few of intermediate size. The average feedlot area is approximately 24 acres but feedlots are better expressed by two figures: those having 50-200 animals and an area of about 10 acres, and those having >1000 animals and perhaps 50 acres or more.

Design criteria should be flexible enough to apply to a variety of different environmental conditions and yet reasonable enough to be affordable and achievable by the feedlot owner. There are many management practices described by the University of Idaho (Taylor 1970), the USDA (1975b), the State of Oregon (ODA 1982), and the U. S. EPA (1972). Most practices are only guidelines that should be used but not required by regulation. Containment requirements, however, should be regulated, and solids removal should be strongly encouraged. Runoff containment is a necessity if significant impact on water quality is to be expected.

Containment Requirements

Impoundments should be sized to provide storage volume able to contain the following: winter runoff commencing with the last practical pumpout date in the late fall or winter through the first practical pumpout date in the spring (not less than 120 days); runoff from a once in 25-year, 24-hour rainfall event; solids, including manure and sediments, that may be carried by runoff; and freeboard of at least 2 feet. Volume may be decreased by estimated evaporation from the pond surface. No allowance for percolation or exfiltration from the pond should be made. The following sections detail these criteria.

Holding Period. Based on temperatures, precipitation, and complaint data from Chapter 3, a holding period of at least 120 days of winter runoff should be incorporated into each pond design. In some areas such as Pocatello, the holding period may need to be longer; the actual period should be determined considering the waste disposal method employed, the latest practical impoundment pumpout date in the spring, and local climatic factors.

Containment Volume.

Runoff. Containment volume should be determined by standard hydrologic methods, using the tributary area to the impoundment; estimated precipitation values; runoff coefficients that assume frozen ground or paved surfaces; evaporation of snowfall consistent with duration on the ground and local winter season evaporation data (or Chapter 3 estimates); NOAA precipitation data; and NOAA rainfall intensity maps for the 25-year, 24-hour storm.

The volume may be determined by assuming runoff from frozen ground equivalent to a once in 5-year winter for the required holding period, plus runoff of a 25-year, 24-hour storm. Runoff for a 1-in-5 yr winter can be calculated using local rainfall data for the period of record and applying evaporation rates and factors (Table 3-5). Alternatively, the impoundment may be sized for runoff from a 25-year winter for months of the holding period. Either method should result in a total runoff of about 4 inches for most areas of southern Idaho.

The total volume (and percent) of runoff varies with slope and soil type. Storm frequency also affects the amount of runoff because it determines the amount of soil moisture prior to the storm. Both the Corps of Engineers (Gilmour et al. 1975) and the SCS (USDA 1975b) have procedures for determining runoff, but the SCS procedure was developed specifically for small watersheds and is a better source for determining cattleyard runoff. Runoff is determined based on a specific hydrologic soil group rating, condition of the surface, slope, length of flow, and previous moisture accumulation. With this procedure, runoff can accurately be predicted; but frozen ground must be taken into account, preferably calculated as nearly impervious surface. Use of an 87 curve number for dirt or a 95 curve number for concrete will provide a conservative estimate (Moffitt pers. comm.)

Waste Flows and Solids. Pond design should include the volume of waste flows from the feeding operation, including washdown water and all other waste sources diverted to the impoundment. The wastes conveyed by rainfall and snowmelt runoff, as well as allowance for sediment from disturbed soils, should be included in the impoundment capacity. Waste flow calculations depend on individual operational activities and may be determined from a number of sources, such as the Oregon Animal Waste Installation Guidebook or other acceptable sources.

The volume of solids included in the design should encompass more than 1 year's inflow unless the managment plan for the operation clearly embodies solids removal as a normal management practice.

Volume allowances for solids and sediments entrained in runoff will vary depending on the steepness of slopes in contact with animals, on soil types, and on animal density.

Freeboard. Freeboard on the pond should be 2 feet above a normal pond level. The infrequent times when this level is attained should not be critical to berm stability. A concrete-lined or rock-lined spillway or a pipeline must be provided so that the pond berm does not erode and fail. This is necessary for those infrequent times when the expected volume is exceeded.

Evaporation. The pond volume computation should also allow for evaporation during winter months. Values used should be conservative, i.e., reflecting local winter rates as opposed to annual average rates, because evaporation in winter tends to be low. Estimated values in Chapter 3 may be used if other local data are unavailable.

Exfiltration. The pond volume should not be adjusted for exfiltration. The degree to which exfiltration from a containment pit can be assumed is controversial. The literature basically supports the idea that dairy or feedlot waste relatively high in solids will seal a containment area, particularly if soils are sandy loam or finer in texture (WSU 1975, Moffit pers. comm., Taylor 1970). Sealing occurs both by mechanical infiltration that plugs pores of the soil and by biological sealing at the soil interface where water infiltration would occur. The biological sealing is essentially the result of an anaerobic process; each time the pond is emptied and exposed to air, this biological seal will require time to become re-established. If some water is allowed to remain in the pit, the seal will be kept (Moffett pers. comm.). In most soil conditions, such as clay loam soils, sealing is effective. If the pond is located on a porous soil or over a lava formation, groundwater contamination may occur. This is a particularly important consideration in areas overlying useable aquifers, such as those along the Snake River. Of the nutrients present in wastes, phosphorus and ammonia nitrogen are generally of less concern, but nitrate nitrogen is very mobile and leaches easily with water through underground flow. Fortunately, nitrate nitrogen concentrations are normally very low and neither the wastes nor the treatment processes convert ammonia nitrogen to nitrate nitrogen.

Pond liners would prevent groundwater contamination but because of the financial burden they impose on the farmer, they should only be required in areas where soils are porous and sealing does not occur or where water supplies are likely to be impacted. There should also be 5-10 feet of separation between groundwater and the pond bottom as a safety factor where possible. In the Twin Falls area, a basalt layer located approximately 4 feet below ground surface limits below-ground impoundment depths to approximately 3 feet, while allowing 1 foot of cover above the basalt (Burkett pers. comm.). A hardpan layer at 4 feet depth in parts of Ada and Owyhee Counties limits depth of impoundments in some areas near Boise as well, although the average depth of impoundments in that area is 7-10 feet (Sheppard pers. comm.). Most impoundments in the Pocatello-Blackfoot region are 6-8 feet deep (Hopson pers. comm.). Some seepage will not be detrimental unless it enters nearby streams. Distance to the stream and soil type will both affect the degree to which seepage enters streams.

Operation and Maintenance Considerations

Proper facility design is only one aspect of pollution control. It must be coupled with proper system maintenance to be effective. Emptying procedures are probably the most vital aspects of proper maintenance if discharges are to be averted. Because a holding period of several months is required in winter, ponds should be emptied prior to the onset of this holding period, normally by around November 1-15 and again in spring when conditions are appropriate for field application. Soil incorporation and crop utilization of manure should be important aspects of manure management plans under most circumstances.

Provisions should be made to minimize the volume of runoff entering containment facilities by routing runoff generated on adjacent areas away from the feedlot, removing roof drainage, reusing water or reducing water usage, or through other BMPs described. Also, under certain geologic conditions when lots have been leveled by excavation, a portion of a hillside subsurface seepage may add to flow quantities. For operations having this condition, a subsurface drain can be provided to route subsurface flow around the lot.

As stated earlier, solids decrease pond capacity, add to organic loadings, and can lead to odors. Solids removal from ponds is difficult because of the need to dry out the pond to allow equipment access. Removing solids prior to storage will lengthen pond life and storage capacity, result in less costly solids removal, and improve quality of discharge by greatly reducing COD levels should overflow of containment facilities occur.

The most economical solids removal system consists of a shallow concrete containment structure with a slope of 0.5-1 percent (Taylor 1970) (Figure 4-3). The alternative is a mechanical solids separation system that requires power and greater maintenance. On the downstream end of this system, screens and boards with openings reduce flow velocities but allow liquid to pass through. Solids are deposited on a concrete slab. After the solids deposition reaches a predetermined level (1-2 feet), solids are removed with a tractor and loader to disposal areas or (during wet weather) to a manure containment area. Solids should be removed for disposal as soon as field conditions permit. With this system, a concrete ramp into the pond for solids removal is unnecessary.

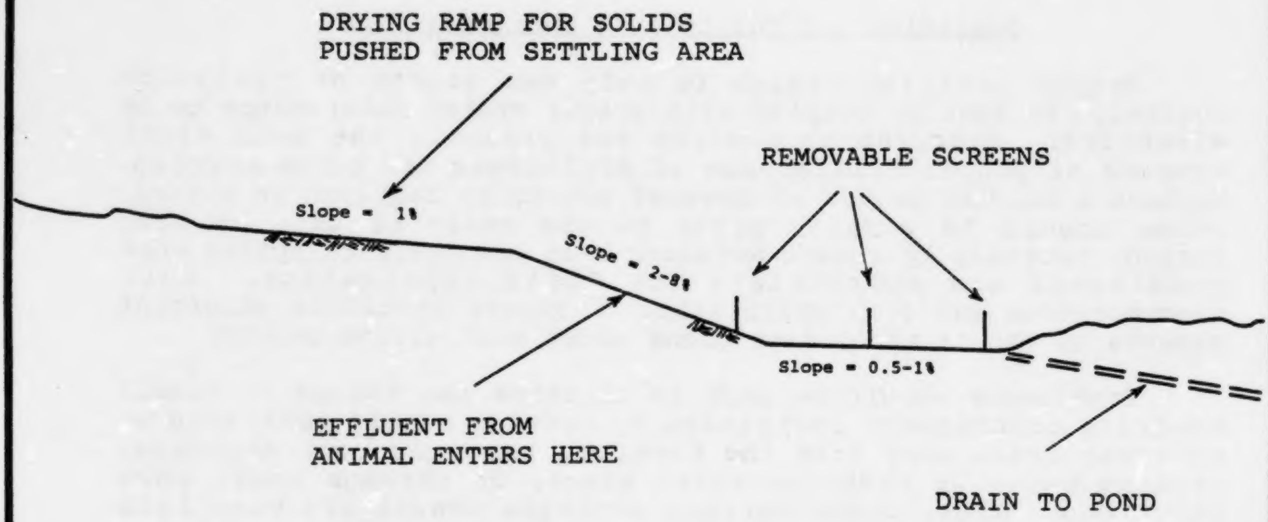

DRYING RAMP FOR SOLIDS
PUSHED FROM SETTLING AREA
REMOVABLE SCREENS
Slope = 1%
Slope = 2-8%
Slope = 0.5-1%
EFFLUENT FROM
ANIMAL ENTERS HERE
DRAIN TO POND

FIGURE 4-3. GENERALIZED SOLIDS REMOVAL SYSTEM
SOURCE: TAYLOR, 1970

A few recent designs have provided for solids removal prior to the liquid entering the pond. In one instance, dairy waste is treated by a vibrating screen to remove solids. The most common design provides a concrete pad with a low slope and shallow sides with a screen or porous dam on the downstream end. This allows liquid to continue into the pond while retaining solids (Renk pers. comm.).

Odor control during summer months depends on rapid manure removal and conditions of aerobic ponds. Odors from aerobic ponds can be minimized by increasing aeration. If the pond is part of an irrigation system, supplemental fresh water is often needed. During these periods, fresh water addition can also reduce odors.

Maintenance of solids removal equipment consists primarily of cleaning as often as possible. Solids removal facilities must be cleaned or they will not work properly. Screens or porous materials downstream of solids removal ponds must also be cleaned regularly to be effective. Cleaning should be weekly, or more frequently if storm conditions persist.

Recommended Management Plan Contents

To adequately address water quality concerns, each farmer under the permit should be required to develop and submit a waste management plan that describes not only the waste containment facility but also the proposed BMPs that will be used. Factors specifically related to water pollution control which should be understood by the farmer and normally specified in each waste facility plan include:

- Drainage area, soils, and topography.
- Expected rainfall and expected runoff (inches).
- Process waste volume, if any.
- Holding period required.
- Present and future expected herd size.
- Total required impoundment volume (not area).
- Date by which facility should be empty prior to the start of winter.
- Identification of final manure disposition site (land and crops available for waste disposal).
- Impoundment emptying procedure.
- Application rate and application time periods.

- Method of manure incorporation into the soil, where applicable.
- Indication that surface and groundwater contamination potential have been considered in relation to surface and subsurface permeability, water tables, and distance to surfacewater.
- Indication of streambank protection (where applicable) either through preventing animal access to streams or by limiting and protecting the access area to minimize the impact.

Chapter 5

NPDES GENERAL PERMIT APPROACHES

Under EPA regulations (40 CFR 122.28), EPA may issue a General Permit to a category of point sources within the same geographic area if the sources:

1. are involved in the same or substantially similar operation;

2. generate and discharge the same types of waste;

3. require the same permit effluent limitations and/or operating conditions;

4. require similar monitoring requirements; and, in the opinion of the Director of the NPDES program, are more appropriately controlled under a General Permit than an individual permit.

As with individual NPDES permits, violation of a General Permit condition constitutes a violation enforceable under Section 309 of the Clean Water Act.

General Permits can cover new sources (i.e., sources established after February 14, 1974) if National Environmental Policy Act (NEPA) requirements are satisfied prior to their inclusion in the permit.

This chapter describes existing NPDES General Permit programs for concentrated animal feeding operations both in states where the NPDES program is EPA-administered and in states where the program enforcement has been delegated to a state agency. The feasibility of a General Permit for Idaho is discussed in light of experiences in other states and the particular circumstances which exist in Idaho. Several alternative enforcement approaches are also discussed.

Existing General Permit Programs

EPA has ultimate responsibility for the NPDES program but has, in many instances, delegated authority for program implementation to individual states. EPA-administered NPDES General Permits for concentrated animal feeding operations are in effect for Utah, South Dakota, and Arizona, and a state administered program using General Permits is in effect for Montana. Oregon has also considered using a General Permit, although present feeling is somewhat against its use. Implementation mechanisms, permit requirements, implementation philosophy, and enforcement procedures vary from state to state and, to some extent, between state-delegated and EPA-administered programs. Individual state programs are discussed briefly below in terms of observed problems and benefits to both enforcement agency and operators. Variations in management which may apply to an Idaho permit program are also discussed.

Federally-Administered General Permits

Arizona. EPA Region 9 favored use of a General Permit in Arizona because it believed that it would be easier to manage one General Permit than many individual permits. Concentrated feeding operations were considered a good category for a General Permit because the effluent limitation regulations are relatively simple. The primary stimulus that caused General Permit issuance was the desire to avoid re-issuing individual permits for 21 operations that were approaching their expiration dates (Lincroft pers. comm.).

Arizona's General Permit was finalized on October 16, 1984. The General Permit lists all of the individual operations covered and is restricted to the 21 previously-permitted operations; it does not include new operations. New sources are required to notify the EPA Regional Administrator within 90 days of the permit's effective date, or not less than 180 days prior to beginning operation. They may be eligible for coverage under the General Permit after complying with environmental assessment requirements under the regulations. Effluent limitations for new sources are the same as those in the General Permit.

The issuance of a General Permit, as opposed to individual permits, will probably make little difference in overall Arizona water quality. The number of permitted sources does not appear likely to increase; there is little reason for farmers to request General Permit coverage unless they are inspected and a violation is found. This does not appear probable, as Arizona does not place a high priority on inspections; even individual permits were never inspected (Lincroft pers. comm.). Because of the dry, warm climate, there are also likely to be few occasions when excessive rainfall conditions occur similar to those in Idaho.

There has been little farmer reaction to the General Permit. This is not surprising; all farmers included in the General Permit previously held individual permits, and the discharge requirements of the Arizona General Permit are somewhat less stringent. For example, General Permit discharge requirements allow farmers to visually monitor their discharge volume, rather than maintain expensive, seldom-used monitoring equipment.

The Arizona permit limitations prohibit process waste discharge (including stormwater runoff) except in the case of a 25-year, 24-hour storm. The General Permit fact sheet indicates these limitations are based on effluent guidelines for Best

Conventional Pollutant Control Technology (BCT) for the feedlots Point Source Category. As with BPT and BAT, BCT is a zero discharge limit. The permit covers discharges of manure and other solid and liquid wastes as well as chemicals from dipping vats and pest and parasite control facilities.

Utah. EPA Region 8 has issued General Permits for both Utah and South Dakota. There were several reasons for their issuance. General Permits were issued for concentrated animal feeding operations primarily as a test case because no General Permits of any kind had been issued in Region 8, and there was concern over the possibility of "losing track" of individual sources under a General Permit. It was also hoped that the General Permit could be used as a publicity tool to increase SCS and ASCS assistance in obtaining voluntary compliance and that it would increase compliance from small operators. The avoidance of individual permit re-issuance was also a consideration in adopting a General Permit.

As a test case for a General Permit, the feedlot permit "failed badly because the bureaucracy would not allow the permit to function." It required 1.5 years to issue the permit. Procedural issues, conflicting views on interpretation of requirements, and requests for demonstrations of detailed cost justifications slowed the process (Fisher pers. comm.).

The Utah General Permit has been effective since May 31, 1983. Content of the General Permit is identical to that of the individual permits. Twelve operations were previously permitted. Approximately 100 operations are presently being regulated to some degree under the General Permit. The switch to a General Permit appears to have had minimal effect on water quality compliance. Some gains were made in the Bear Creek area, but this was through increased enforcement efforts and not the result of the General Permit per se (Fisher pers. comm.).

Permit conditions are essentially identical to those of the Arizona permit. The permit uses a BCT discharge standard based on effluent guidelines in 40 CFR 412, the Feedlot Point Source Category, and prohibits discharge except as the result of a 25-year, 24-hour storm event.

Initial reactions to the Utah program are viewed somewhat differently by EPA and state personnel. EPA personnel indicated farmer reaction was slight, as informational mailings to agricultural groups produced few comments (Fisher pers. comm.). In contrast, individuals in the Utah Bureau of Water Quality, perhaps because of their closer contact with the farmers, described a "violent reaction" by the farmers in the beginning. This was apparently due to farmer misunderstanding. Many farmers thought the General Permit was a new program; once they understood the primary change was a reduction in paperwork and that the program would not be essentially different from the existing program, it was accepted with little problem (Hildon pers. comm.). No fees are involved.

South Dakota. The South Dakota General Permit has been in effect since July 29, 1982. The farmers have had no problems with the new system, and it has generally reduced paperwork for permit issuance. Approximately 90 individually permitted operations became covered under the General Permit after their individual permits expired. Additional operations have been identified primarily as the result of complaints. Using the General Permit has had little affect on either the breadth or degree of enforcement because the state has always concentrated primarily on problem sites, and the individual permits were always somewhat of a formality. The fact that the NPDES program is not state-delegated, however, is recognized as affecting enforcement. EPA generally wants to evaluate sources before beginning enforcement, which slows the process greatly unless enforcement proceedings are instituted under state laws (Fisher pers. comm.).

Like the Arizona and Utah permits, South Dakota requires containment of all process-generated waste plus runoff from a 25-year, 24-hour rainfall event. It also states that land areas utilized and operated under the authority of the permittee for the disposal or storage of manure or other wastes shall be isolated to prevent pollutants from such materials from entering waters of the United States. Discharges from dipping vats and pest or parasite control units are also covered by the permit. It differs from the other permits, however, in that it also states that "diffused drainage of natural precipitation on agricultural land resulting from a `nonpoint source' is not subject to conditions of the permit ..."

There is no permit application process used in either Utah or South Dakota because EPA Region 8 believes that if a facility is in compliance with the permit requirements, then a permit is not required under the NPDES Appendix B regulations (Fisher pers. comm.). These regulations define animal feeding operations but then paradoxically state, "provided, however, that no animal feeding operation is a concentrated animal feeding operation as defined above, if such animal feeding operation discharges only in the event of a 25-year, 24-hour storm event" (Appendix B to part 122). That is, if an operation is in compliance with the permit requirements, it ceases to be considered a confined feeding operation. If no violations are noted, a feedlot is considered in compliance and therefore not in need of a permit.

Both EPA and the state believe that the main advantage of the General Permit is that it is more equitable and easier to apply. Thousands of feedlots exist. Under the individual permit system, generally only those who voluntarily applied were permitted; many operations that should have been permitted were not, although any operation noted to fall under the regulations can be required to obtain a permit. The General Permit provides the appearance of less arbitrary enforcement by providing a more uniformly-administered program under a broader-based structure. The permit requirements cover all operations and can therefore be applied to any specific situation. The "cosmetic value" of the

General Permit is primarily valuable only if little or no enforcement is intended.

In practice, EPA monitoring and enforcement have been minimal for operations in South Dakota. EPA keeps no list of operations falling under the permit (Fisher pers. comm.). The state maintains some files and carries out some inspections. Health and SCS districts also provide information on operations which should be monitored (Hildon pers. comm.).

The main negative aspect of the general South Dakota permit is the difficulty in tracking individual sources. It is difficult to schedule compliance inspections as there are more sources, and there is less pressure for inspections because compliance schedules are not defined under a General Permit (Bower pers. comm.). Operations in South Dakota may also change greatly from year to year; number of cattle in a single operation may vary by an order of magnitude, and operations often close and re-open or change ownership. Under individual permits, this situation often made information in permit files obsolete by the time of permit renewal. It also makes present record keeping and tracking of individual operations under a General Permit more difficult (Bower pers. comm.).

State-Administered General Permits

Montana. In Montana, EPA Region 8 delegated NPDES enforcement responsibility to the State Department of Health and Environmental Science in 1975. The state has used a MPDES (Montana Pollutant Discharge Elimination System) General Permit to regulate animal feeding operations since 1982. It turned to a General Permit primarily to streamline the permit process and reduce paperwork. The farmers also benefit to some extent because permit issuance is faster. They have been otherwise unaffected (Schuman pers. comm.).

Under the Administrative Rules of Montana, EPA-issued NPDES permits serve as MPDES permits until their date of expiration. The permit prohibits discharge of process wastewater except in case of a 25-year, 24-hour storm (or a like amount falling in any 15-day period which is considered to be a "chronic" or "catastrophic" condition as specified in the regulations).

Enforcement capability has not changed under the General Permit because the system which has been instituted allows the agency to keep close track of the individuals. The Montana system appears to take advantage of the reduced paperwork requirements under the General Permit process while maintaining the individuality of the sources that exist under the individual permit system. Dischargers are required to apply on a regular MPDES form, are reviewed, and then are notified if they qualify for inclusion under the General Permit. Permittees are logged in and a separate file is maintained for each facility. All files are kept together in one location and can be inspected like regular permits. Delegation of enforcement to the states probably allows greater control than can be achieved under an EPA-administered program because the states may have a better feel for the local situation (Schuman pers. comm.).

Oregon. In Oregon, the Department of Environmental Quality (ODEQ) was delegated management of the NPDES program several years ago by EPA Region 10. ODEQ has not issued a General Permit for animal feeding operations but is presently considering the possibility. Oregon is included for discussion here because it has had extensive experience with other NPDES General Permits and because it is known for its environmental consciousness. It may, therefore, be expected to provide a conservative approach to General Permits as they relate to water quality.

Oregon has issued General Permits for a wide variety of activities including cooling water discharges, water treatment plant backwash, fish hatcheries, log ponds, gold mines (no discharge), sewer maintenance activities, oily-water runoff, seafood processing, gravel mining (no discharge), and land disposal and subsurface treatment systems. Overall, General Permits have worked well for these activities. Budget constraints limit inspection personnel and are one reason ODEQ has instituted some types of General Permits. The primary problem with these General Permits has been providing adequate notice to individuals to induce them to get a permit (Baton pers. comm.).

Issuance of a General Permit has not totally eliminated individual permits; some individuals prefer to keep their own permit, particularly when a facility has more than one type of activity or discharge. If a facility does not meet all General Permit requirements, the department may also prefer to maintain an individual permit so that special attention can be paid to particular aspects of the operation.

Oregon General Permits are typically more stringent than individual permits, and any proposed General Permit for feedlots would be expected to be stringent also (Baton pers. comm.). This is primarily true because the permit is not tailored to address individual sites or to provide site-specific water quality protection. The Department therefore attempts to write a General Permit that covers all potential situations which may arise in different operations. Because of concern that a General Permit for feeding operations could not adequately cover all situations, it may be difficult for Oregon to ever institute a General Permit for these sources (Baton pers. comm.).

Oregon believes issuance of a General Permit generally tends to affect enforcement to some extent. Under individual permits, operations are tracked for compliance with at least yearly inspections for minor discharges, while major discharges may be inspected up to 3 or 4 times a year depending on the source.

Under a General Permit, there would probably be fewer inspections because of time constraints (Baton pers. comm.).

Issuing a General Permit has one distinct local disadvantage for ODEQ: it results in a monetary loss to the state. Individual permits presently require a compliance inspection fee, while General Permits do not. Fees vary, but most feedlot compliance inspection fees average approximately $100. Major sources may run as high as $425. Oregon is considering attaching a compliance inspection fee to General Permits as well and may revise 1985 permits to include a fee (Baton pers. comm.).

Conclusions Concerning Existing General Permits

After review of the existing General Permits for animal feeding operations, several generalizations can be made:

- Both EPA and state personnel agree that General Permits reduce paperwork for the permitting agency by eliminating time-consuming review of individual applications. In some states, depending on local procedures, they can also reduce industry's burden in applying for and obtaining a permit. The degree to which compliance and inspection paperwork is generated or reduced depends primarily on the emphasis of the enforcing agency, rather than the form of the permit used.
- The paperwork reduction frees time that can often be used for higher priorities, such as inspections. This can be a particularly important aspect where manpower is limited.
- Once understood by the agricultural community, general feedlot permits have been well accepted. In no case, however, have the General Permits varied to any great degree from the individual permit requirements. Should this occur, farmer acceptance may be less enthusiastic.
- The General Permit provides at least the appearance of a more uniformly-administered program with less arbitrary enforcement.
- The General Permit will not automatically result in improved water quality, nor is it likely to increase the number of operators that express interest in the program.
- General Permit effectiveness depends on state and federal attitudes concerning enforcement. It also depends on the degree to which the permitting agency establishes and maintains a good tracking system which includes inspections and compliance monitoring.
- A General Permit cannot cover all site-specific situations. Some individual permits may still be

necessary if complete water quality protection is required or if the operation has a variety of discharges.

- The possibility exists that the enforcement agency will lose track of individual sources under a General Permit. This is particularly possible under a federally-administered program and/or where EPA program headquarters are located out of state. In such a situation, strong support and encouragement of state enforcement efforts is valuable. In Idaho, the EPA Idaho Operations Office can provide a valuable local presence.
- State-administered programs generally allow closer monitoring and better enforcement than federally-administered ones, as federally-administered programs tend to be both physically and emotionally farther removed from actual interaction with the operations.

Considerations in Issuing a General Permit for Idaho

The concept of a General Permit for Idaho feeding operations is not new. A General Permit was proposed in 1981 but was never finalized. The proposed permit allowed for issuance of individual permits where potentially severe water quality impacts existed. It would also have allowed the state and areawide 208 planners to request a facilities exclusion from the General Permit where more stringent permit limitations were desirable. The permit specified initial limitations and conditions based on BPT guidelines, with final limitations based on BAT guidelines and required by July, 1983. The permit was intended to apply to beef cattle feedlots (SIC 0211), hog feedlots (SIC 0213), sheep and goat feedlots (SIC 0214), general livestock (SIC 0219), dairy farms (SIC 0241), poultry farms (SIC 0251-0254 and 0259), and animal specialties (SIC 0271).

Based on information from other states, a General Permit is feasible for Idaho. There are a few potential benefits to any General Permit, including the reduction in paperwork for both EPA and the farmer, and the appearance of a more uniformly administered program.

As discussed above, agency approaches and policies, magnitude of confined feeding operation impact, and attitude toward enforcement vary widely from state to state and region to region. The enforcement approaches and attitudes taken by EPA and the state, not the form of the permit itself, will be the ultimate determiner of the program's success.

Until recently, interest in enforcement of NPDES permit requirements for Idaho operations has been minimal. This is evidenced by the fact that although many operations have been permitted for nearly 10 years, most still do not have impoundments of any kind. Unless a committment to greater enforcement activity is made, this situation should not be expected to change under a General Permit. Experience with other states indicates changing to a General Permit will not, in itself, result in water quality improvement. A General Permit may, in fact, result in losing track of some sources, particularly if enforcement is not initiated at the state level. Like other permits, a General Permit is only as effective as its enforcement.

In many aspects, the situation in Idaho appears similar to that of South Dakota. Both states are basically agricultural; both have less than 100 large previously-permitted operations and hundreds, if not thousands, of smaller operations. Neither state has been delegated NPDES enforcement responsiblity and neither has an EPA regional headquarters within the state. As in South Dakota, Idaho farms vary greatly in number of animals from year to year, and they frequently change status or ownership. To some extent, the results of implementing an Idaho General Permit are, therefore, likely to resemble those of South Dakota unless additional management policies or strategies are implemented. The presence of the Idaho Operations Office is expected to provide a valuable local EPA presence.

Several levels of implementation and enforcement are possible as can be seen from the existing permits. At one extreme, Arizona lists previously permitted operations in the General Permit and ignores all of the others. The low number (21) indicates that only large operations, probably those over 1,000 animals, fall under the permit. At the other extreme, the Montana permit covers a large number of operations, treating each operation almost as if it had a separate permit. Dischargers are notified to apply, and an individual file is maintained for each operation.

The General Permit regulations are broad enough to include nearly any size of operation if it is found to produce significant water quality degradation. Essentially, the General Permit may cover three categories of operations. Various enforcement possibilities exist: 1) permit only the largest operations (>1,000 beef or 700 dairy cattle), 2) also permit operations having >300 beef or 200 dairy cattle that discharge to or have contact with a ditch or waterway, and 3) add smaller operations to the first two categories on a case-by-case basis if they are found to be causing a pollution problem. Because there is a large number of smaller operations, and because smaller operations cause the majority of the water quality problems, a more comprehensive enforcement using this third option would be preferable. Limiting the permit coverage to operations previously permitted or to those having over 1,000 animals will produce little water quality improvement, particularly in the Twin Falls and Blackfoot study areas.

Personnel limitations have caused IDHW to prioritize their enforcement. Present priorities of the Twin Falls office (and apparently of other areas as well) are complaints, followed by discharges to live streams, and lastly by discharges to canals (Renk pers. comm.). If the General Permit is to function as more than a mere piece of paper, it will be important to at least initiate contact with all of the operations in the first and second categories as well as known smaller problem dischargers.

To avoid losing track of sources under an Idaho General Permit, an application form (no matter how abbreviated) should be obtained from each source being covered by the permit. A listing or file can then be established for each identified source. This at least sets the stage for follow up on improvements to individual operations as time allows. Operations identified in the aerial survey and in Chapter 2 of this report can help to establish the initial group of permit holders. A systematic identification and enforcement effort that includes source tracking and follow-up inspections, particularly in known water quality problem areas, will be important if any water quality improvement is to be expected.

Because of the large number of sources, establishing an enforcement system similar to that which Colorado uses for their individual permit program may be appropriate for Idaho. In Colorado, once a source has implemented acceptable BMPs that meet permit criteria, the file is essentially inactivated. In an area with numerous sources and limited manpower, this allows enforcement personnel to focus on the important sources and keeps the 'active' sources to a manageable number. The one caveat with this approach is that a correctly designed facility will not prevent water pollution unless properly maintained. For these 'inactive' files, a form letter could be issued each fall by IDHW reminding operators to pump their facilities. This would keep the IDHW role active in the minds of the operators and likely prevent some discharges as well.

To avoid identification problems and confusion where many sources are under the same ownership, it would be advisable to assign clearly different names to each source and use them consistently on all report forms. Development of standardized complaint and inspection forms which require a definite set of information would also help to ensure the recording of all pertinent information and would facilitate data retrieval when original personnel may no longer be present.

An effort should also be made to enlist greater cooperation and involvement from the American Dairy Association, Cattle Feeders Association, district health departments, and SCS (whose role appears to have declined in recent years). Some progress in this direction has recently been made in the Twin Falls area through the establishment of an advisory committee composed of IDHW, ASCS, SCS, dairymen, health department personnel, and others. Although newly established, it is hoped that it will result in increased awareness and cooperation among the involved groups. Establishment of a similar committee in each IDHW region may be appropriate, since sources, problems, and personnel differ in each region. It may also be appropriate to include a representative from EPA on the committee.

Alternative Enforcement Approaches

EPA has several regulatory alternatives available. It can issue individual permits; it can issue a General Permit with one set of conditions that apply statewide; it can issue both a General Permit and individual permits; or it can issue a General Permit that specifies additional criteria for operations located in sensitive areas. These sensitive areas might be stream segments where existing water quality is poor; areas where large concentrations of feedlots and dairies exist; areas with high resource value or sensitive uses; or areas where groundwater pollution is of greatest concern. These areas were partially addressed in Chapter 2. Regardless of the option adopted, there are a number of enforcement strategies or approaches that can be taken once a permit (in whatever form) has been issued. Several of these have been used elsewhere fairly successfully.

A number of organizations and agencies are involved in dairy and feedlot regulation or management. Most of the enforcement approaches discussed below involve a greater degree of involvement by these groups or by the industries themselves.

Alternative 1: Intensive Public Education Program With Emphasis on Voluntary Compliance

This approach could be used with either type of permit, or with no permits at all, at least for smaller operations. The Jackson County Soil and Water Conservation District in Oregon has successfully used this approach with small (<50head) CAFOs. The area is somewhat different than Idaho because many of the farms are small: approximately 50 percent of the agricultural land and 90 percent of the ownership in the Bear Creek Basin are parcels of 20 acres or less. Management practices affecting runoff "are generally inferior to those on large commercial farms" (Jackson SWCD 1980). However, there are also some similarities. The number of farmers in the basin was considered too large to be reached on a one-to-one technical assistance program, so the Jackson Soil and Water Conservation District has concentrated on a totally voluntary program. Regulatory options were not considered feasible by the ODEQ because of the large number of small operators. (Moore pers. comm.).

The program is based upon a massive education effort that includes workshops, farm tours, a quarterly farm newsletter (with a mailing list derived from letters, phone calls, and sign-up sheets), news releases and interviews on TV and radio, slide shows, civic group talks, and displays at county fairs. It is coupled with monitoring of sites to determine priorities and evaluate progress. The following 5-year planning, implementation and evaluation sequence was developed:

- Select drainages for concentrated action.

- Evaluate farms and assign priorities for plans and BMP implementation.

- Establish monitoring sites and sampling schedules.

- Develop methods to evaluate and document BMP effectiveness.

- Review and evaluate progress annually, and change the 5-year plan as needed (Jackson SWCD 1980).

Implementing a plan and education effort such as this on a state-wide basis would require some decentralization to be efficient. Perhaps dividing the state into units corresponding to the conservation districts would be the most likely strategy for implementation.

Under a voluntary approach, farmers may develop a more positive attitude than with a regulatory approach. Many regulatory personnel in Idaho believe that such a voluntary "carrot" approach may work better than the regulatory "stick." Education is an important aspect of any program because there is a lack of manpower in IDHW (McMasters, Hopson pers. comm.) and in the conservation districts as well.

There are several reasons why a totally voluntary approach such as this one would probably not work well for much of the state. For one thing, a massive educational effort requires a great deal of sustained manpower, which may be a problem. There is also a need for continual education of new farmers, particularly in areas where numbers are growing rapidly, such as Twin Falls.

The aerial photo survey shows that even under a regulatory system, large numbers of previously permitted operations showed no impoundment construction although containment facilities were specifically required in the permit. Over 10 years have elapsed since the first permits were issued, but the industry as a whole does not seem inclined to police itself or provide voluntary compliance. There seems little reason to believe this situation will change in the near future. Many of the farms in Idaho are large and control facilities can be expensive. A larger amount of "carrot" may be necessary.

Alternative 2: Voluntary Emphasis with Financial and Technical Assistance

A voluntary approach that is coupled with financial and technical assistance has been used with success in Coos Bay, Oregon, and is also possible for Idaho. It could be strictly voluntary (for small farms) or used with either type of permit.

The Coos Bay drainage is heavily agricultural and contains a number of large dairy operations. The Bacterial Water Quality Management Plan (Coos Bay CWQC 1983) provides an approach that supplements voluntary compliance with both agricultural expertise and special funds to assist in BMP implementation. The Soil and Water Conservation District Work Plan prioritizes district areas needing improvement and encourages use of a set of BMPS adopted by the State Soil and Water Conservation Commission. Both the SCS and Oregon Department of Environmental Quality (ODEQ) have agreed to assist the Coos Bay Conservation District in identifying and correcting problems upon request, and the Oregon State University Cooperative Extension Service encourages farmers to review their management practices. The Coos Bay Conservation District applied for "special ACP project funds" from the Agricultural Stabilization and Conservation Service (ASCS) to assist farmers in the designated priority areas.

To a certain extent, this approach exemplifies the current Idaho situation. Idaho is one of the few states with an agricultural cost share program. IDHW has an agricultural grant program associated with the water pollution control fund. It may provide 75 percent cost share up to $50,000 per farm for the installation of BMPs (Moore pers. comm.). A number of other self-help or funding programs are available also, as discussed briefly in Chapter 2. Although this approach may provide assistance to some individual farms, it may not be feasible statewide, as funding is not sufficient given the large number of operations. Some priority areas could benefit, however. Additional conservation district personnel might also be required.

Alternative 3: Combined Voluntary and Regulatory Emphasis

A combined voluntary and regulatory approach is presently used in Tillamook County, Oregon. Like southern Idaho, the County contains a dense concentration of dairies in proximity to waterbodies supporting quality-sensitive uses. Their approach to dairy waste management, as outlined in the Tillamook Fecal Waste Management Plan (ODEQ and TWQC 1981), is a two-phased strategy. The first phase is voluntary and the second mandatory. The voluntary phase involves monitoring of stream quality, accompanied by an aggressive educational program and assistance by the local soil and water conservation districts to help farmers develop effective Waste Management Plans and correct situations referred by complaints. A Water Quality Committee, Annual Evaluation Committee, and the Conservation District annually review the plan's progress to determine its effectiveness and to decide whether the mandatory phase is necessary. The mandatory enforcement phase can be implemented at the district, watershed, or individual level. To implement the mandatory compliance phase, the Conservation District notifies the state Division of Soil and Water Conservation that they cannot handle the problem (districts have no enforcement capability), and the ODEQ then enforces state water pollution regulations. Because ODEQ is represented on both Water Quality and Annual Evaluation Committees, the agency is constantly involved in review and decision making (Pedersen pers. comm.).

One advantage of this plan is the flexibility to implement the mandatory enforcement phase at several levels, depending on problem severity. Enforcement by the state allows local conservation districts to maintain a good working relationship with the farmer and may also facilitate cleanup, as the relationship between the state and the violator is more impersonal. The Oregon plan is working well without the need for large-scale phase-two implementation (Pedersen pers. comm.). One disadvantage of this strategy is that violations are corrected after-the-fact rather than prevented. Water quality therefore depends on the success of educational programs and willingness of new farmers to incorporate BMPs while an operation is still in the planning stage.

In Idaho, certain drainage areas could be designated for phase-two implementation based on the water quality of adjacent stream segments, farm density, and proximity to streams. Enforcement could be concentrated on sensitive stream segments or areas where water quality is poorest. Like the previous alternatives, this approach could be used with either type of permit. Given the personnel limitations, a prioritizing approach is probably advisable regardless of the permit type.

Alternative 4: Source "Declassification" After BMP Implementation

This enforcement alternative is used statewide in Colorado to manage confined feeding operations under individual permits.

In Colorado, EPA Region 8 delegated NPDES enforcement responsibility to the State Department of Health in 1975. Colorado approaches regulation of feeding operations in a slightly different manner than many other states. An attempt is made to regulate all operations. As there are "several thousand" in the northeast section of the state alone, continued individual follow up is a lower priority than other problems (Love pers. comm.). The Department requires all operators to work with SCS and to construct detention facilities. Colorado regulations require existing facilities to design for a 10-year, 24-hour storm and new operations to design for a 25-year, 24-hour storm. Regulations also require the operator to provide and operate a waste disposal system capable of restoring these retention requirements within 15 days of a precipitation event unless impeded by inclement weather. A written certificate is required from SCS, and the system is inspected to ensure it has been constructed. Once a system is built to contain runoff from a 25-year storm event, the file is inactivated and no further follow-up occurs because the state interprets the Appendix B regulations to mean that the operation is no longer classified as an animal feeding operation. A few enforcement actions have been necessary. The SCS works with both feedlots and dairies, and its involvement is the primary reason the program works well (Love pers. comm.).

The SCS in Colorado has been responsible for design of perhaps 75 percent of the facilities but recently has preferred to work mainly with smaller operators (3,000 head or less; Chuckel pers. comm.). In Idaho, SCS involvement has been more limited. Some districts, such as in the Caldwell area, generally avoid dealing with feedlots. Also, their designs are often "too well done"; state IDHW and SCS personnel in all three of the study areas indicate that the cost of such a well-designed system is often prohibitive. Many designed plans are thus never built or are altered to cut costs. If specifications are not followed, cost sharing cannot be provided. As the SCS involvement was felt to be crucial to success of the Colorado program, providing a workable program in Idaho would probably involve several changes such as increasing the number of SCS personnel and perhaps determining ways to cut construction costs without sacrificing facility design integrity. This seems possible; as discussed previously, design changes which reduced costs by 50 percent were still found to be functional in Pocatello (Hopson pers. comm.).

Alternative 5: Upgrade Health Department Requirements and Diversify Enforcement.

The district health departments are required to inspect all grade A dairies. Part of the requirements for a grade A dairy include a proper waste disposal system. Present enforcement is sometimes lax, but regulations concerning these systems presently lack both penalties and a description of an acceptable waste system. If regulations were strengthened to include these omissions and a greater effort toward enforcement were made by the health departments by cancelling permits and downgrading dairies to grade B for noncompliance, much of the problem in the Twin Falls and Blackfoot study areas might be controlled. Many dairies presently have impoundments, but they are inadequately sized. To assure water quality protection, it would be necessary to ensure that facility design included volume of runoff and that a maximum number of cattle/acre were stipulated for each farm. This would assure facilities do not become undersized if a farmer expands his herd. Although this would not control feedlots or grade B dairies, there are few feedlots in the Twin Falls and Blackfoot regions.

One disadvantage of this alternative is that it would be of limited benefit in the Caldwell area, which contains the majority of the large feedlots and also has some of the poorest water quality in the state. Because of their numbers and because they are often the more marginal facilities, grade B dairies are a problem in all three study areas. It would be necessary for another agency or group, such as IDHW, to assume responsibility for the feedlots (and grade B dairies) on an individual permit. This enforcement method seems cumbersome. Regardless of the enforcement system selected, the ability of these organizations to help EPA and IDHW to achieve compliance, particularly in the southcentral and southwestern portions of the state, should be recognized and their involvement encouraged.

Regardless of whether a General Permit or individual permits are used and what mixture of "carrot and stick" is chosen, tracking of individual sources is believed to be a must if the system is to function well. Furthermore, because of the lack of manpower at state and local levels, prioritization of areas and sources is believed important. Areas and sources of greatest concern are discussed in Chapter 2.

REFERENCES

Literature Cited

Ada Soil Conservation District. 1982. Livestock waste. March Newsletter. Meridian, ID.

Coos Bay Citizens Water Quality Committee, Coos Bay Water Quality/Shellfish Technical Advisory Committee, and Oregon Department of Environmental Quality. 1983. Coos Bay drainage basin bacterial water quality management plan. 86 pp.

Environmental Protection Agency. 1972. Cattle feedlots and the environment. Region 10, Seattle, WA.

____________. 1974. Development document for proposed effluent limitations guidelines and new source performance standards for the feedlots point source category. EPA 440/1-73/004. 318 pp.

____________. 1984a. Aerial photographic analysis of confined animal feeding operations: Caldwell area, Idaho. April, 1984. Vol. 1. TS-AMD-84076a. EPA Environmental Monitoring Systems Laboratory, Las Vegas, NV. 55 pp.

____________. 1984b. Aerial photographic analysis of confined animal feeding operations: Twin Falls area, Idaho. April, 1984. Vol. 3. TS-AMD-84076c. EPA Environmental Monitoring Systems Laboratory, Las Vegas, NV.

____________. 1984c. Aerial photographic analysis of confined animal feeding operations: Blackfoot area, Idaho. April, 1984. Vol. 2. TS-AMD-84076b. EPA Environmental Monitoring Systems Laboratory, Las Vegas, NV. 69 pp.

____________. 1985. Aerial photographic analysis of confined animal feeding operations: Twin Falls area, Idaho. April, 1984. Vol. 4. TS-AMD-84076. EPA Environmental Monitoring System Laboratory, Las Vegas, NV. 99 pp.

Gilmour, C. M., S. M. Beck, J. H. Milligan, L. L. Mink, R. L. Reid, A. A. Araji, and R. E. Taylor. 1975. Users manual for selection of feedlot sites and land disposal of feedlot manure. Contract DACW 68-73-C-0202. U. S. ACOE, Walla District. 47 pp.

Graham, W. G., and L. J. Campbell. 1981. Groundwater resources of Idaho. Idaho Department of Water Resources. Boise, ID. 100 pp.

Idaho Department of Health & Welfare, Division of Environment. 1984a. Dairies can impact Idaho's water. Clean Water Newsletter, Spring 1984. Boise.

____________. 1984b. Idaho environmental quality profile, 1984. Boise. 33 pp.

____________. 1984c. Idaho water quality status report, 1984.

____________. 1983a. Idaho environmental quality profile, 1983. Boise. 31 pp.

____________. 1983b. Idaho water quality standards and wastewater treatment requirements.

____________. 1981. Idaho water quality status report, 1980. 40 pp.

Jackson Soil and Water Conservation District. 1980. Five-year work plan, agricultural water quality, Bear Creek Basin, Jackson Co., OR. 33 pp.

Martin, S. B. 1983. Groundwater quality management plan for Idaho. Idaho Department of Health and Welfare, Division of Environment. Boise.

Meinzer, O. (ed.). 1942. Physics of the earth - IX. Hydrology. Dover Publications, Inc., New York, NY.

National Oceanic and Atmospheric Administration. 1983. Precipitation frequency atlas of the western United States. Volume V-Idaho.

____________. 1976. Climatography of the United States, no. 20. Climate of Twin Falls, Id.

____________. 1983a. Local climatological data: Annual summary with comparable data. Pocatello, Id.

____________. 1983b. Local climatological data: Annual summary with comparable data. Boise, Id.

Oregon Department of Agriculture, Division of Soil & Water Conservation. 1982. Oregon animal waste installation guidebook. 226 pp.

Oregon Department of Environmental Quality, and Tillamook Water Quality Committee. 1981. Tillamook Bay drainage basin fecal waste management plan.

Renk, R. 1981. Memorandum to Mike Smith on Al's program guidance on review of SCS design animal waste treatment. January 5.

Shulyer, L.R., D.M. Farmer, R.D. Kreis, and M.E. Hula. 1973. Environment protecting concepts of beef cattle feedlot wastes management. Project #20AOY-05. EPA, Corvallis, OR.

Taylor, R. 1970. The Idaho livestock producer and the pollution problem. University of Idaho. Miscellaneous Series 11.

U. S. Department of Agriculture, Soil Conservation Service. 1971. Soil survey of Canyon area, Idaho.

____________. 1973. Soil survey of the Bingham area, Idaho. 123 pp.

____________. 1975a. Urban hydrology for small watersheds. Technical Release No. 55.

____________. 1975b. Agricultural waste management field manual.

____________. 1980. Soil survey of Ada County, Idaho. 327 pp.

____________. 1984a. General soil map and landform provinces of Idaho. Map.

____________. 1984b. Status of soil surveys. Map.

Washington State University. 1975. Lagoons for livestock and poultry waste. College of Agriculture, Cooperative Extension Service. Extension Bulletin 655. 14pp.

Whitehead, R. L., and D. J. Parliman. 1979. A proposed groundwater quality monitoring network for Idaho. USGS open file report 79-1477. Boise, ID. 67 pp.

Personal Communications

Allred, W. 1984. Department of Health, Jerome, ID. Dairy concerns in Jerome and Gooding. Meeting, December 13.

Baton, L. Chief of Permits Management, Water Quality Division. Oregon Department of Environmental Quality. Discussion of general permits in Oregon. Telephone conversation, October 19.

Becker, D. 1984. Lockheed Engineering and Management Co., Inc., Las Vegas, NV. Aerial survey techniques. Telephone conversation, October.

Bower, J. 1984. Resource Specialist. South Dakota Department of Water and Natural Resources. Information on the South Dakota general permit. Telephone conversation, October 26.

Brower, C. 1985. Senior Water Quality Analyst. Idaho Department of Health and Welfare, Boise. Groundwater information. Telephone conversation, March 15.

Burkett, G. 1985. Environmental Engineer. Idaho Department of Health and Welfare, Twin Falls. Impoundment design. Telephone conversation, March 15.

Chuckel, R. 1984. Colorado Department of Health, Permits Section. Information on the Colorado feedlot permits. Telephone conversation, December 5.

Clark, W. 1984. Idaho Department of Health & Welfare, Boise. Feedlots in Gem and Valley Counties. Telephone conversation, October 1.

Collings, T. 1984. District Environmentalist. Idaho Department of Health, Gooding. Dairy impacts. Meeting, December 13.

Curtis, D. 1984. Conservationist. Soil Conservation Service, Pocatello, ID. Dairy impacts. Meeting, December 11.

Davidson, R. 1984. Soil Conservation Service, Jerome, ID. Dairy concerns. Meeting, December 13.

Fisher, M. 1984. EPA Region 8, Denver, CO. Discussion of general permits for Utah and South Dakota. Telephone conversation, October 19.

Hasslen, D. 1984. U. S. Department of Agriculture Statistical Reporting Service. Data on number of feedlots, dairies, and cattle in Idaho. Telephone conversation, December 7.

Hildon, D. 1984. Utah State Department of Health, Water Quality Division. Utah general permits information. Telephone conversation, October 26.

Hopson, G. 1984. Idaho Department of Health & Welfare. Dairy and feedlot issues in the Pocatello region. Meeting, December 10.

James, T. 1984. Lincoln County Soil Conservation Service. Dairy Waste Plans. Meeting, December 13.

Lincroft, A. 1984. EPA Region 10, NPDES Section, San Francisco, CA. Information on the general permit for Arizona feedlots. Telephone conversation, October 19.

Love, J. 1984. Colorado State Department of Health, Permits Section. Discussion on feedlot permits in Colorado. Telephone conversation, October 23.

McCollum, E. 1985. Twin Falls Soil Conservation Service Field Office, Twin Falls, ID. Soils in the Twin Falls area. Telephone conversation, January 10.

McMasters, M. 1984. Idaho Department of Health & Welfare, Twin Falls. Dairy concerns. Meeting, December 12.

Moffitt, D. 1985. Western National Technical Center, Soil Conservation Service. Portland, OR. State of the art design criteria. Telephone conversation, April 2.

Moore, E. 1984. EPA Region 10, Seattle, WA. Animal waste management. Telephone conversation, June.

Morrison, R. 1984. Agricultural Technician. Idaho Department of Health & Welfare, Twin Falls. Dairies and feedlots in the Twin Falls vicinity. Meeting, December 12.

Mullen, B. 1985. Drinking Water Section, EPA Region 10, Seattle, WA. Sole Source Aquifer designation and the Snake River plain aquifer. Telephone conversation, March 18. Memo, March 22.

Newbeisner, M. 1984. Conservationist. Soil Conservation Service, Twin Falls, ID. Dairies in the Twin Falls area. Meeting, December 12.

O'Rourke, P. 1984. Environmental Health Specialist. South Central District Health Department, Twin Falls, ID. Dairies. Meeting, December 12.

Palmer, J. 1984. Idaho Department of Public Health, Pocatello. Dairies in the Pocatello area. Meeting, December 11.

Pedersen, B. 1984. District Conservationist. Soil Conservation Service, Tillamook, OR. Animal waste management. Telephone conversation, June 25.

Renk, R. 1984. Environmental Engineer. Idaho Department of Health & Welfare, Twin Falls. Feedlot and dairy concerns. Meeting, December 12.

Schuman, F. 1984. Head of Permits. Montana State Department of Health & Environmental Science. Discussion regarding feedlot general permit for Montana. Telephone conversation, October 23.

Sheppard, C. 1985. Idaho Department of Health and Welfare, Division of Environment, Boise. Impoundment design. Telephone conversation, March 26.

Shock, G. 1985. Idaho Department of Health and Welfare, Central Office. Boise. Groundwater contamination problems. Telephone conversation July 2.

Zollinger, L. 1984. Soil Conservation Service, Boise, ID. SCS activities regarding feedlots and dairies. Telephone conversation, December 5.

APPENDIX A

Precipitation Data

Table A-1. Precipitation Adjusted for Evaporation Using Fall River Mills Rates and Evaporation Opportunity Factors

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1944	0	0.14	0	2.09	0	2.04	0.06	0	0.16	0	0.59	0.22	5.32
1945	0	1.11	0.64	0	1.63	0.78	0.07	0.08	0.44	0.01	0.50	1.37	6.66
1946	0.23	0.25	0.55	0	0	0.13	0.04	0.26	0.16	0.50	1.04	0	3.19
1947	0	0	0.72	0	0.44	0.8	0	0.05	0.8	1.57	0.26	0	4.66
1948	0	0.52	0.3	0.54	0.33	1.57	0.08	0.05	0.31	0.07	0.01	1.24	5.06
1949	0	0.99	0	0	0.15	0.37	0	0.12	0.19	0.59	0.39	0	2.83
1950	1.39	0.03	0.89	0	0.69	0.92	0.04	0.52	0.92	0	0.52	1.32	7.27
1951	0.52	1.10	0	0.11	0.36	0.7	0.29	0.07	0.01	0.99	0.79	1.60	6.59
1952	0.10	0.06	0.93	0.25	0.50	1.1	0.15	0	0.05	0	0	0.13	3.30
1953	2.21	0.43	0	0.69	2.01	1.22	0	0.12	0.02	0	0.30	0.28	7.32
1954	0	0	0.08	0	0.37	1.1	0.06	0.24	0.08	0	0	0.22	2.16
1955	0.18	0	0	2.21	0.90	0.63	0.39	0	0.12	0.13	0.42	1.35	6.37
1956	1.03	0	0	0.79	1.60	0.8	0.15	0.08	0.02	1.64	0	0	6.14
1957	0	0.66	1.15	0.32	2.21	0.25	0	0	0.06	0	0	1.21	5.88
1958	0.23	0.85	0	1.11	1.47	2.94	0.48	0.53	0.12	0	0.03	0.41	8.21
1959	0.19	0	0	0	1.10	0.27	0	0.64	2.54	0.15	0	0	4.91
1960	0.19	0.68	0.27	0	0.63	0.01	0.95	0.83	0.29	0	0.81	0	4.69
1961	0	0.14	0.27	0	0	0.55	0.25	0.21	0.79	1.15	0	0.03	3.41
1962	0	0	0.15	0.09	2.32	0.12	0.04	0.12	0.4	0.61	0.66	0	4.54
1963	0	0.64	0	0.82	0.27	1.9	0	0.64	0.75	0.38	1.40	0.15	6.99
1964	1.32	0	0	0.52	1.18	2	0.41	0.53	0.7	0	1.32	2.32	10.33
1965	1.75	0	0	1.98	0.22	1.2	0.25	0.88	0.55	0	0.50	0	7.36
1966	0	0	0	0	0	0.01	0.06	0.01	0.19	0	0.59	0.54	1.41
1967	0.35	0	0	0.64	0	1.07	0.05	0	0.58	0	0	0	2.70
1968	0	0.80	0	0	0	0.6	0	2.37	0.1	0.09	0.49	1.08	5.56
1969	2.36	0	0	0.52	0	2	0.02	0	0.68	0.03	0	0.90	6.54
1970	2.73	0	0	0.10	0.15	1.72	0.28	0.1	1	0.20	1.02	0.50	7.84
1971	0.90	0	0.38	0	0	1.58	0.12	0.18	0.64	0	1.31	0.76	5.89
1972	1.01	0	0.38	0	0	0.9	0.21	0.05	1.11	0.03	0.10	0.92	4.74
1973	0.00	0	0	0.66	0.16	0.19	0.07	0.03	0.82	0.54	1.43	1.36	5.30
1974	0.21	0	0.38	0	0	0.6	0.53	0.22	0	0.84	0	0.84	3.64
1975	0	1.56	0.8	0.70	0.30	0.78	0.82	0.48	0.01	1.38	0	0.42	7.28
1976	0.35	0.25	0	0.77	0	1.66	1.15	0.95	2.11	0	0	0	7.26
1977	0	0	0	0	1.22	1.26	0.41	0.73	1.2	0	0.85	1.59	7.28
1978	1.23	0.44	0.31	1.51	0	0.56	0.48	0.24	0.89	0	0.05	0	5.73
1979	0.79	0.14	0	0.77	0.70	0.18	0.01	1.81	0.04	0.89	0.29	0	5.66
1980	0.42	0.23	1.02	0.37	3.19	0.58	0.03	0	1.59	0	0.25	0.62	8.34
1981	0.06	0	1.64	1.10	0.37	0.77	0.23	0.13	0.36	0.36	1.23	1.85	8.14
1982	0.28	0.48	0.27	0	0	0.35	1.62	0.19	1.38	1.13	0.09	1.05	6.87
1983	0.53	0.20	1.58	1.46	1.35	0.17	1.16	0.28	0.65	0	0.86	3.36	11.64

TABLE A-2: COMPLAINT DATA SORTED IN ORDER OF 7-DAY ANTECEDENT PRECIPITATION

Date	Daily Precip	7-Day Precip	30-Day Precip	90-Day Precip	120-Day Precip	# of Complaints
28-May-80		2.18	3.52	6.85	8.14	t2
24-Mar-81		1.68	2.14	5.46	6.33	c1
25-Mar-81	0.24	1.68	2.14	5.46	6.17	c1
12-Jan-79		1.45	1.62	1.73	1.78	t1
13-Dec-83	0.21	1.30	2.96	4.80	4.99	t1,c1
14-Dec-83	0.49	1.20	3.16	5.01	5.20	c2
12-Dec-83	0.14	1.19	2.98	4.66	4.85	c1
21-Dec-81	0.33	1.18	2.46	5.00	5.01	c1
14-Mar-83	0.02	1.17	2.20	6.21	7.21	t1
11-Apr-79	0.05	1.12	1.62	4.65	4.99	t1
18-Mar-83	0.10	1.02	1.79	5.74	7.21	t1
16-Feb-82	0.06	1.00	2.12	7.50	7.73	c1
15-Mar-83	0.01	0.99	2.17	6.17	7.23	t1
20-Mar-84		0.93	1.49	5.95	7.86	1p
26-Jan-82	0.08	0.85	1.95	6.51	7.28	c1
28-Jan-82	0.06	0.79	2.01	6.59	7.33	c1
13-May-80		0.79	1.91	5.30	6.25	c1
22-Mar-82		0.73	1.36	6.90	8.01	t1
05-Jan-84		0.65	3.84	7.31	7.31	t2
27-Jan-84		0.59	1.42	7.11	8.08	t1
28-Nov-83	0.02	0.58	1.72	2.95	3.13	t1
09-Dec-82		0.54	1.62	4.77	4.95	t1
25-Mar-82		0.54	1.27	6.73	7.55	t1
24-Mar-82		0.54	1.28	6.85	7.68	t2
16-Feb-84	0.01	0.52	1.11	7.07	7.63	t1
16-Feb-79	0.02	0.49	0.98	3.63	4.30	t1
15-Feb-79		0.49	0.98	3.63	4.30	c2
13-Apr-82		0.48	1.61	4.82	7.68	t1
05-Mar-81		0.46	1.46	4.49	5.41	c1
12-Apr-82	0.04	0.44	1.57	4.78	7.69	t2
18-Dec-81	0.26	0.43	1.60	4.09	4.22	t1
28-Apr-83	0.14	0.43	1.39	4.90	6.44	t2
04-Mar-83	0.02	0.36	1.40	5.37	6.10	t1
14-Apr-82	0.05	0.35	1.56	4.82	7.56	c1
14-Oct-83		0.32	0.97	1.28	2.53	t1
13-Feb-84	0.20	0.32	0.91	7.14	7.43	c1
14-Nov-83		0.32	0.88	2.04	2.16	t1
12-May-82		0.31	0.43	3.94	5.21	t1
28-Feb-80	0.01	0.31	1.29	4.61	4.88	t1
17-May-82	0.07	0.28	0.34	3.18	5.21	c4
01-Jun-81		0.27	0.93	5.64	6.64	t1
10-Jun-81	0.02	0.27	1.15	5.45	6.88	t1
29-Mar-79		0.24	0.70	3.63	4.61	t1
14-Mar-84	0.13	0.24	0.79	5.72	7.34	c1
05-Dec-79		0.23	1.49	3.07	4.88	t1,c1
25-Apr-79		0.23	1.84	3.51	5.23	c1
09-Jul-81		0.23	0.73	3.74	6.18	t1
26-Feb-82		0.23	1.60	6.89	8.19	t1
13-Mar-84	0.02	0.22	0.99	5.92	7.33	t1
26-Feb-79	0.02	0.20	1.05	3.88	4.55	c1
30-Mar-84		0.18	1.43	4.76	7.53	c1
18-Apr-79	0.08	0.17	1.63	3.32	5.08	c1
23-Mar-83		0.17	1.84	5.89	6.81	c1

Using Boise Idaho precipitation data.

TABLE A-2: COMPLAINT DATA SORTED IN ORDER OF 7-DAY ANTECEDENT PRECIPITATION

Date	Daily Precip	7-Day Precip	30-Day Precip	90-Day Precip	120-Day Precip	# of Complaints
08-Apr-80		0.17	1.86	4.95	5.67	c1
20-Oct-83		0.16	0.97	1.28	2.53	t1
22-Feb-83	0.02	0.15	1.21	5.59	6.99	t1
21-Mar-83		0.15	1.79	5.84	6.92	c1
25-Jun-79		0.13	0.18	3.30	3.83	t1
22-Mar-83	0.05	0.13	1.79	5.84	6.85	t1
06-Apr-81		0.12	2.42	5.08	6.33	t1
12-Mar-84	0.11	0.11	0.88	5.84	7.38	t1
12-Feb-79	0.09	0.11	0.66	3.17	3.84	c1
24-Feb-83		0.10	1.18	5.61	6.95	c2
09-Feb-83	0.03	0.10	0.92	4.80	6.12	t1,c1
05-Jan-79		0.09	0.28	1.73	2.60	c1
29-Jun-83		0.09	0.17	4.75	7.28	c1
16-Jun-83		0.07	0.08	5.59	7.39	t1
17-Apr-79	0.10	0.07	1.53	3.22	4.98	c1
11-Dec-79		0.07	1.50	3.08	4.89	c1
15-Feb-80	0.04	0.04	0.60	3.83	5.21	c1
07-Nov-79		0.04	1.54	3.39	3.39	c1
11-Feb-81	0.02	0.03	1.23	3.98	4.28	t1
09-Jan-84		0.03	3.29	7.30	7.31	c1
10-Feb-84	0.08	0.02	0.79	6.92	7.29	t1
07-Sep-79		0.02	1.81	2.00	2.00	c1
19-Apr-81	0.45	0.02	2.45	5.11	6.24	c1
22-Aug-82		0.02	0.11	2.00	2.42	t1
24-Jun-80		0.01	1.74	5.47	7.42	c1
11-Nov-81		0.00	0.25	1.46	1.46	t1
10-Nov-81		0.00	0.38	1.46	1.46	t1
23-Jan-81	0.50	0.00	1.13	2.83	3.06	t1
20-Sep-79		0.00	0.15	1.86	2.00	c1
18-Apr-83		0.00	1.35	4.96	6.52	c1
29-Jun-81		0.00	1.02	3.64	6.40	t1
06-May-82		0.00	0.56	3.65	4.90	t1
26-Apr-82		0.00	0.88	3.84	5.90	t1
22-Apr-80	0.04	0.00	0.39	3.73	5.41	c1
17-Apr-81		0.00	2.44	5.09	6.22	t1
20-Aug-80		0.00	0.00	2.79	5.12	t1
20-Apr-80		0.00	0.67	3.73	5.62	c1
04-Feb-84		0.00	0.77	6.98	7.43	t1
29-Jun-79		0.00	0.18	3.06	3.76	c1
21-Apr-80		0.00	0.39	3.73	5.45	c1

Using Boise Idaho precipitation data.

TABLE A-3: COMPLAINT DATA SORTED IN ORDER OF 30-DAY ANTECEDENT PRECIPITATION

Date	Daily Precip	7-Day Precip	30-Day Precip	90-Day Precip	120-Day Precip	# of Complaints
05-Jan-84		0.65	3.84	7.31	7.31	t2
28-May-80		2.18	3.52	6.85	8.14	t2
09-Jan-84		0.03	3.29	7.30	7.31	c1
14-Dec-83	0.49	1.20	3.16	5.01	5.20	c2
12-Dec-83	0.14	1.19	2.98	4.66	4.85	c1
13-Dec-83	0.21	1.30	2.96	4.80	4.99	t1,c1
21-Dec-81	0.33	1.18	2.46	5.00	5.01	c1
19-Apr-81	0.45	0.02	2.45	5.11	6.24	c1
17-Apr-81		0.00	2.44	5.09	6.22	t1
06-Apr-81		0.12	2.42	5.08	6.33	t1
14-Mar-83	0.02	1.17	2.20	6.21	7.21	t1
15-Mar-83	0.01	0.99	2.17	6.17	7.23	t1
25-Mar-81	0.24	1.68	2.14	5.46	6.17	c1
24-Mar-81		1.68	2.14	5.46	6.33	c1
16-Feb-82	0.06	1.00	2.12	7.50	7.73	c1
28-Jan-82	0.06	0.79	2.01	6.59	7.33	c1
26-Jan-82	0.08	0.85	1.95	6.51	7.28	c1
13-May-80		0.79	1.91	5.30	6.25	c1
08-Apr-80		0.17	1.86	4.95	5.67	c1
23-Mar-83		0.17	1.84	5.89	6.81	c1
25-Apr-79		0.23	1.84	3.51	5.23	c1
07-Sep-79		0.02	1.81	2.00	2.00	c1
21-Mar-83		0.15	1.79	5.84	6.92	c1
22-Mar-83	0.05	0.13	1.79	5.84	6.85	t1
18-Mar-83	0.10	1.02	1.79	5.74	7.21	t1
24-Jun-80		0.01	1.74	5.47	7.42	c1
28-Nov-83	0.02	0.58	1.72	2.95	3.13	t1
18-Apr-79	0.08	0.17	1.63	3.32	5.08	c1
09-Dec-82		0.54	1.62	4.77	4.95	t1
11-Apr-79	0.05	1.12	1.62	4.65	4.99	t1
12-Jan-79		1.45	1.62	1.73	1.78	t1
13-Apr-82		0.48	1.61	4.82	7.68	t1
26-Feb-82		0.23	1.60	6.89	8.19	t1
18-Dec-81	0.26	0.43	1.60	4.09	4.22	t1
12-Apr-82	0.04	0.44	1.57	4.78	7.69	t2
14-Apr-82	0.05	0.35	1.56	4.82	7.56	c1
07-Nov-79		0.04	1.54	3.39	3.39	c1
17-Apr-79	0.10	0.07	1.53	3.22	4.98	c1
11-Dec-79		0.07	1.50	3.08	4.89	c1
20-Mar-84		0.93	1.49	5.95	7.86	1p
05-Dec-79		0.23	1.49	3.07	4.88	t1,c1
05-Mar-81		0.46	1.46	4.49	5.41	c1
30-Mar-84		0.18	1.43	4.76	7.53	c1
27-Jan-84		0.59	1.42	7.11	8.08	t1
04-Mar-83	0.02	0.36	1.40	5.37	6.10	t1
28-Apr-83	0.14	0.43	1.39	4.90	6.44	t2
22-Mar-82		0.73	1.36	6.90	8.01	t1
18-Apr-83		0.00	1.35	4.96	6.52	c1
28-Feb-80	0.01	0.31	1.29	4.61	4.88	t1
24-Mar-82		0.54	1.28	6.85	7.68	t2
25-Mar-82		0.54	1.27	6.73	7.55	t1
11-Feb-81	0.02	0.03	1.23	3.98	4.28	t1
22-Feb-83	0.02	0.15	1.21	5.59	6.99	t1

Using Boise Idaho precipitation data.

TABLE A-3: COMPLAINT DATA SORTED IN ORDER OF 30-DAY ANTECEDENT PRECIPITATION

Date	Daily Precip	7-Day Precip	30-Day Precip	90-Day Precip	120-Day Precip	# of Complaints
24-Feb-83		0.10	1.18	5.61	6.95	c2
10-Jun-81	0.02	0.27	1.15	5.45	6.88	t1
23-Jan-81	0.50	0.00	1.13	2.83	3.06	t1
16-Feb-84	0.01	0.52	1.11	7.07	7.63	t1
26-Feb-79	0.02	0.20	1.05	3.88	4.55	c1
29-Jun-81		0.00	1.02	3.64	6.40	t1
13-Mar-84	0.02	0.22	0.99	5.92	7.33	t1
15-Feb-79		0.49	0.98	3.63	4.30	c2
16-Feb-79	0.02	0.49	0.98	3.63	4.30	t1
14-Oct-83		0.32	0.97	1.28	2.53	t1
20-Oct-83		0.16	0.97	1.28	2.53	t1
01-Jun-81		0.27	0.93	5.64	6.64	t1
09-Feb-83	0.03	0.10	0.92	4.80	6.12	t1,c1
13-Feb-84	0.20	0.32	0.91	7.14	7.43	c1
26-Apr-82		0.00	0.88	3.84	5.90	t1
12-Mar-84	0.11	0.11	0.88	5.84	7.38	t1
14-Nov-83		0.32	0.88	2.04	2.16	t1
14-Mar-84	0.13	0.24	0.79	5.72	7.34	c1
10-Feb-84	0.08	0.02	0.79	6.92	7.29	t1
04-Feb-84		0.00	0.77	6.98	7.43	t1
09-Jul-81		0.23	0.73	3.74	6.18	t1
29-Mar-79		0.24	0.70	3.63	4.61	t1
20-Apr-80		0.00	0.67	3.73	5.62	c1
12-Feb-79	0.09	0.11	0.66	3.17	3.84	c1
15-Feb-80	0.04	0.04	0.60	3.83	5.21	c1
06-May-82		0.00	0.56	3.65	4.90	t1
12-May-82		0.31	0.43	3.94	5.21	t1
22-Apr-80	0.04	0.00	0.39	3.73	5.41	c1
21-Apr-80		0.00	0.39	3.73	5.45	c1
10-Nov-81		0.00	0.38	1.46	1.46	t1
17-May-82	0.07	0.28	0.34	3.18	5.21	c4
05-Jan-79		0.09	0.28	1.73	2.60	c1
11-Nov-81		0.00	0.25	1.46	1.46	t1
25-Jun-79		0.13	0.18	3.30	3.83	t1
29-Jun-79		0.00	0.18	3.06	3.76	c1
29-Jun-83		0.09	0.17	4.75	7.28	c1
20-Sep-79		0.00	0.15	1.86	2.00	c1
22-Aug-82		0.02	0.11	2.00	2.42	t1
16-Jun-83		0.07	0.08	5.59	7.39	t1
20-Aug-80		0.00	0.00	2.79	5.12	t1

Using Boise Idaho precipitation data.

TABLE A-4: COMPLAINT DATA SORTED IN ORDER OF 90-DAY ANTECEDENT PRECIPITATION

Date	Daily Precip	7-Day Precip	30-Day Precip	90-Day Precip	120-Day Precip	# of Complaints
16-Feb-82	0.06	1.00	2.12	7.50	7.73	c1
05-Jan-84		0.65	3.84	7.31	7.31	t2
09-Jan-84		0.03	3.29	7.30	7.31	c1
13-Feb-84	0.20	0.32	0.91	7.14	7.43	c1
27-Jan-84		0.59	1.42	7.11	8.06	t1
16-Feb-84	0.01	0.52	1.11	7.07	7.63	t1
04-Feb-84		0.00	0.77	6.98	7.43	t1
10-Feb-84	0.08	0.02	0.79	6.92	7.29	t1
22-Mar-82		0.73	1.36	6.90	8.01	t1
26-Feb-82		0.23	1.60	6.89	8.19	t1
28-May-80		2.18	3.52	6.85	8.14	t2
24-Mar-82		0.54	1.28	6.85	7.68	t2
25-Mar-82		0.54	1.27	6.73	7.55	t1
28-Jan-82	0.06	0.79	2.01	6.59	7.33	c1
26-Jan-82	0.08	0.85	1.95	6.51	7.28	c1
14-Mar-83	0.02	1.17	2.20	6.21	7.21	t1
15-Mar-83	0.01	0.99	2.17	6.17	7.23	t1
20-Mar-84		0.93	1.49	5.95	7.86	1p
13-Mar-84	0.02	0.22	0.99	5.92	7.33	t1
23-Mar-83		0.17	1.84	5.89	6.81	c1
21-Mar-83		0.15	1.79	5.84	6.92	c1
12-Mar-84	0.11	0.11	0.88	5.84	7.38	t1
22-Mar-83	0.05	0.13	1.79	5.84	6.85	t1
18-Mar-83	0.10	1.02	1.79	5.74	7.21	t1
14-Mar-84	0.13	0.24	0.79	5.72	7.34	c1
01-Jun-81		0.27	0.93	5.64	6.64	t1
24-Feb-83		0.10	1.18	5.61	6.95	c2
22-Feb-83	0.02	0.15	1.21	5.59	6.99	t1
16-Jun-83		0.07	0.08	5.59	7.39	t1
24-Jun-80		0.01	1.74	5.47	7.42	c1
25-Mar-81	0.24	1.68	2.14	5.46	6.17	c1
24-Mar-81		1.68	2.14	5.46	6.33	c1
10-Jun-81	0.02	0.27	1.15	5.45	6.88	t1
04-Mar-83	0.02	0.36	1.40	5.37	6.10	t1
13-May-80		0.79	1.91	5.30	6.25	c1
19-Apr-81	0.45	0.02	2.45	5.11	6.24	c1
17-Apr-81		0.00	2.44	5.09	6.22	t1
06-Apr-81		0.12	2.42	5.08	6.33	t1
14-Dec-83	0.49	1.20	3.16	5.01	5.20	c2
21-Dec-81	0.33	1.18	2.46	5.00	5.01	c1
18-Apr-83		0.00	1.35	4.96	6.52	c1
08-Apr-80		0.17	1.86	4.95	5.67	c1
28-Apr-83	0.14	0.43	1.39	4.90	6.44	t2
14-Apr-82	0.05	0.35	1.56	4.82	7.56	c1
13-Apr-82		0.48	1.61	4.82	7.68	t1
09-Feb-83	0.03	0.10	0.92	4.80	6.12	t1,c1
13-Dec-83	0.21	1.30	2.96	4.80	4.99	t1,c1
12-Apr-82	0.04	0.44	1.57	4.78	7.69	t2
09-Dec-82		0.54	1.62	4.77	4.95	t1
30-Mar-84		0.18	1.43	4.76	7.53	c1
29-Jun-83		0.09	0.17	4.75	7.28	c1
12-Dec-83	0.14	1.19	2.98	4.66	4.85	c1
11-Apr-79	0.05	1.12	1.62	4.65	4.99	t1

Using Boise Idaho precipitation data.

TABLE A-4: COMPLAINT DATA SORTED IN ORDER OF 90-DAY ANTECEDENT PRECIPITATION

Date	Daily Precip	7-Day Precip	30-Day Precip	90-Day Precip	120-Day Precip	# of Complaints
28-Feb-80	0.01	0.31	1.29	4.61	4.88	t1
05-Mar-81		0.46	1.46	4.49	5.41	c1
18-Dec-81	0.26	0.43	1.60	4.09	4.22	t1
11-Feb-81	0.02	0.03	1.23	3.98	4.28	t1
12-May-82		0.31	0.43	3.94	5.21	t1
26-Feb-79	0.02	0.20	1.05	3.88	4.55	c1
26-Apr-82		0.00	0.88	3.84	5.90	t1
15-Feb-80	0.04	0.04	0.60	3.83	5.21	c1
09-Jul-81		0.23	0.73	3.74	6.18	t1
22-Apr-80	0.04	0.00	0.39	3.73	5.41	c1
21-Apr-80		0.00	0.39	3.73	5.45	c1
20-Apr-80		0.00	0.67	3.73	5.62	c1
06-May-82		0.00	0.56	3.65	4.90	t1
29-Jun-81		0.00	1.02	3.64	6.40	t1
15-Feb-79		0.49	0.98	3.63	4.30	c2
29-Mar-79		0.24	0.70	3.63	4.61	t1
16-Feb-79	0.02	0.49	0.98	3.63	4.30	t1
25-Apr-79		0.23	1.84	3.51	5.23	c1
07-Nov-79		0.04	1.54	3.39	3.39	c1
18-Apr-79	0.08	0.17	1.63	3.32	5.08	c1
25-Jun-79		0.13	0.18	3.30	3.83	t1
17-Apr-79	0.10	0.07	1.53	3.22	4.98	c1
17-May-82	0.07	0.28	0.34	3.18	5.21	c4
12-Feb-79	0.09	0.11	0.66	3.17	3.84	c1
11-Dec-79		0.07	1.50	3.08	4.89	c1
05-Dec-79		0.23	1.49	3.07	4.88	t1,c1
29-Jun-79		0.00	0.18	3.06	3.76	c1
28-Nov-83	0.02	0.58	1.72	2.95	3.13	t1
23-Jan-81	0.50	0.00	1.13	2.83	3.06	t1
20-Aug-80		0.00	0.00	2.79	5.12	t1
14-Nov-83		0.32	0.88	2.04	2.16	t1
07-Sep-79		0.02	1.81	2.00	2.00	c1
22-Aug-82		0.02	0.11	2.00	2.42	t1
20-Sep-79		0.00	0.15	1.86	2.00	c1
12-Jan-79		1.45	1.62	1.73	1.78	t1
05-Jan-79		0.09	0.28	1.73	2.60	c1
10-Nov-81		0.00	0.38	1.46	1.46	t1
11-Nov-81		0.00	0.25	1.46	1.46	t1
14-Oct-83		0.32	0.97	1.28	2.53	t1
20-Oct-83		0.16	0.97	1.28	2.53	t1

Using Boise Idaho precipitation data.

TABLE A-5: COMPLAINT DATA SORTED IN ORDER OF 120-DAY ANTECEDENT PRECIPITATION

Date	Daily Precip	7-Day Precip	30-Day Precip	90-Day Precip	120-Day Precip	# of Complaints
26-Feb-82		0.23	1.60	6.89	8.19	t1
28-May-80		2.18	3.52	6.85	8.14	t2
27-Jan-84		0.59	1.42	7.11	8.08	t1
22-Mar-82		0.73	1.36	6.90	8.01	t1
20-Mar-84		0.93	1.49	5.95	7.86	1p
16-Feb-82	0.06	1.00	2.12	7.50	7.73	c1
12-Apr-82	0.04	0.44	1.57	4.78	7.69	t2
24-Mar-82		0.54	1.28	6.85	7.68	t2
13-Apr-82		0.48	1.61	4.82	7.68	t1
16-Feb-84	0.01	0.52	1.11	7.07	7.63	t1
14-Apr-82	0.05	0.35	1.56	4.82	7.56	c1
25-Mar-82		0.54	1.27	6.73	7.55	t1
30-Mar-84		0.18	1.43	4.76	7.53	c1
04-Feb-84		0.00	0.77	6.98	7.43	t1
13-Feb-84	0.20	0.32	0.91	7.14	7.43	c1
24-Jun-80		0.01	1.74	5.47	7.42	c1
16-Jun-83		0.07	0.08	5.59	7.39	t1
12-Mar-84	0.11	0.11	0.88	5.84	7.38	t1
14-Mar-84	0.13	0.24	0.79	5.72	7.34	c1
28-Jan-82	0.06	0.79	2.01	6.59	7.33	c1
13-Mar-84	0.02	0.22	0.99	5.92	7.33	t1
05-Jan-84		0.65	3.84	7.31	7.31	t2
09-Jan-84		0.03	3.29	7.30	7.31	c1
10-Feb-84	0.08	0.02	0.79	6.92	7.29	t1
29-Jun-83		0.09	0.17	4.75	7.28	c1
26-Jan-82	0.08	0.85	1.95	6.51	7.28	c1
15-Mar-83	0.01	0.99	2.17	6.17	7.23	t1
18-Mar-83	0.10	1.02	1.79	5.74	7.21	t1
14-Mar-83	0.02	1.17	2.20	6.21	7.21	t1
22-Feb-83	0.02	0.15	1.21	5.59	6.99	t1
24-Feb-83		0.10	1.18	5.61	6.95	c2
21-Mar-83		0.15	1.79	5.84	6.92	c1
10-Jun-81	0.02	0.27	1.15	5.45	6.88	t1
22-Mar-83	0.05	0.13	1.79	5.84	6.85	t1
23-Mar-83		0.17	1.84	5.89	6.81	c1
01-Jun-81		0.27	0.93	5.64	6.64	t1
18-Apr-83		0.00	1.35	4.96	6.52	c1
28-Apr-83	0.14	0.43	1.39	4.90	6.44	t2
29-Jun-81		0.00	1.02	3.64	6.40	t1
06-Apr-81		0.12	2.42	5.08	6.33	t1
24-Mar-81		1.68	2.14	5.46	6.33	c1
13-May-80		0.79	1.91	5.30	6.25	c1
19-Apr-81	0.45	0.02	2.45	5.11	6.24	c1
17-Apr-81		0.00	2.44	5.09	6.22	t1
09-Jul-81		0.23	0.73	3.74	6.18	t1
25-Mar-81	0.24	1.68	2.14	5.46	6.17	c1
09-Feb-83	0.03	0.10	0.92	4.80	6.12	t1,c1
04-Mar-83	0.02	0.36	1.40	5.37	6.10	t1
26-Apr-82		0.00	0.88	3.84	5.90	t1
08-Apr-80		0.17	1.86	4.95	5.67	c1
20-Apr-80		0.00	0.67	3.73	5.62	c1
21-Apr-80		0.00	0.39	3.73	5.45	c1
05-Mar-81		0.46	1.46	4.49	5.41	c1

Using Boise Idaho precipitation data.

TABLE A-5: COMPLAINT DATA SORTED IN ORDER OF 120-DAY ANTECEDENT PRECIPITATION

Date	Daily Precip	7-Day Precip	30-Day Precip	90-Day Precip	120-Day Precip	# of Complaints
22-Apr-80	0.04	0.00	0.39	3.73	5.41	c1
25-Apr-79		0.23	1.84	3.51	5.23	c1
17-May-82	0.07	0.28	0.34	3.18	5.21	c4
15-Feb-80	0.04	0.04	0.60	3.83	5.21	c1
12-May-82		0.31	0.43	3.94	5.21	t1
14-Dec-83	0.49	1.20	3.16	5.01	5.20	c2
20-Aug-80		0.00	0.00	2.79	5.12	t1
18-Apr-79	0.08	0.17	1.63	3.32	5.08	c1
21-Dec-81	0.33	1.18	2.46	5.00	5.01	c1
11-Apr-79	0.05	1.12	1.62	4.65	4.99	t1
13-Dec-83	0.21	1.30	2.96	4.80	4.99	t1,c1
17-Apr-79	0.10	0.07	1.53	3.22	4.98	c1
09-Dec-82		0.54	1.62	4.77	4.95	t1
06-May-82		0.00	0.56	3.65	4.90	t1
11-Dec-79		0.07	1.50	3.08	4.89	c1
05-Dec-79		0.23	1.49	3.07	4.88	t1,c1
28-Feb-80	0.01	0.31	1.29	4.61	4.88	t1
12-Dec-83	0.14	1.19	2.98	4.66	4.85	c1
29-Mar-79		0.24	0.70	3.63	4.61	t1
26-Feb-79	0.02	0.20	1.05	3.88	4.55	c1
16-Feb-79	0.02	0.49	0.98	3.63	4.30	t1
15-Feb-79		0.49	0.96	3.63	4.30	c2
11-Feb-81	0.02	0.03	1.23	3.98	4.28	t1
18-Dec-81	0.26	0.43	1.60	4.09	4.22	t1
12-Feb-79	0.09	0.11	0.66	3.17	3.84	c1
25-Jun-79		0.13	0.18	3.30	3.83	t1
29-Jun-79		0.00	0.18	3.06	3.76	c1
07-Nov-79		0.04	1.54	3.39	3.39	c1
28-Nov-83	0.02	0.58	1.72	2.95	3.13	t1
23-Jan-81	0.50	0.00	1.13	2.83	3.06	t1
05-Jan-79		0.09	0.28	1.73	2.60	c1
20-Oct-83		0.16	0.97	1.28	2.53	t1
14-Oct-83		0.32	0.97	1.28	2.53	t1
22-Aug-82		0.02	0.11	2.00	2.42	t1
14-Nov-83		0.32	0.88	2.04	2.16	t1
20-Sep-79		0.00	0.15	1.86	2.00	c1
07-Sep-79		0.02	1.81	2.00	2.00	c1
12-Jan-79		1.45	1.62	1.73	1.78	t1
11-Nov-81		0.00	0.25	1.46	1.46	t1
10-Nov-81		0.00	0.38	1.46	1.46	t1

Using Boise Idaho precipitation data.

APPENDIX B

Characterization of Runoff from Idaho Feedlots and Dairies

COPY DISTRIBUTION
White - Person Requesting Test
Canary - Laboratory
Pink - Water Quality Bureau (Storet)
Goldenrod - Extra as needed

NOV 04 '80
DIVISION OF
ENVIRONMENT

BUREAU OF WATER QUALITY
BUREAU OF LABORATORIES

WATER QUALITY REPORT
CHEMICAL REPORT

See Back For Instructions

LAB NAME (Check One)
☐ Boise
☐ Caldwell
☐ Coeur d'Alene
☐ Idaho Falls
☐ Lewiston
☐ Pocatello
☒ Twin Falls

STORET No. ______
NPDES No. ______
Date of Collection (Yr., Mo., Day) ______
Time of Collection ______ (24 Hr. Clock) Depth (Meters) ______ Circle One DM DBM DVM

Sampling Point Location [redacted] Dairy (urine) [illegible]
Date Submitted (Yr., Mo., Day) Oct 27, 1980
Submitted By Russ [illegible]

PURPOSE OF SAMPLE (Check one)
☐ Intensive Survey ☐ Trend
☐ Compliance ☐ Other ______

TYPE OF SAMPLES (Check appropriate boxes)
☐ Wastewater ☐ Raw ☐ Final ☐ Chlorinated
☐ Grab ☐ Cross Composite ☐ Depth Integrated
☐ Composite: Begin ______ End ______

SAMPLE TAKEN FROM (Check one)
☐ Spring ☐ Creek ☐ River ☐ Reservoir ☐ Well
☐ Lake ☐ Lagoon ☐ STP ☑ Industrial ☐ Drain

PRESERVED SAMPLES SUBMITTED
☐ Cooled, 4° C ☐ HNO_3
☐ H_2SO_4 ☐ NaOH ☐ Other ______

STORET Code		DEMAND (mg/L)	
(00310)	☑	BOD_5(Est: 8,000)	LA
(00335)	☐	COD Low Level	
(00340)	☑	High Level	49,056
(00680)	☐	TOC	
		NUTRIENTS (mg/L)	
(00610)	☐	T. Ammonia as N	
(00615)	☐	T. Nitrite as N	
(00620)	☐	T. Nitrate as N	
(00630)	☐	T. $NO_2 + NO_3$ as N	
(00625)	☐	T. Kjeldahl Nitrogen as N	
(00665)	☐	T. Phosphorus as P	
(00669)	☐	T. Hydrolyzable Phosphorus as P	
(70507)	☐	Ortho Phosphate as P	
		MINERALS (mg/L)	
(00095)	☐	Sp. Conductance (umhos/cm)	
(00900)	☐	Hardness as $CaCO_3$	
(00410)	☐	T. Alkalinity as $CaCO_3$	
(00425)	☐	Bicarbonate Alk. as $CaCO_3$	
(00430)	☐	Carbonate Alk. as $CaCO_3$	
(00916)	☐	Calcium	
(00927)	☐	Magnesium	
(00929)	☐	Sodium	
(00937)	☐	Potassium	
(00940)	☐	Chloride	
(00951)	☐	Fluoride	
(00945)	☐	Sulphate as SO_4	
(00956)	☐	Silica as SiO_2	
( )	☐	Other Minerals	
		MISCELLANEOUS	
(00076)	☐	Turbidity (NTU)	
(00403)	☐	pH (SU)	
(00720)	☐	Total Cyanide (mg/L)	
(00116)	☐	Intensive Survey No.	

RETURN TEST RESULTS TO
Name
Address
City State File Code

STORET Code		RESIDUE (mg/L)	
(00500)	☐	Total Residue	
(00530)	☐	Non-Filterable Residue (105° C) (Suspended Solids)	
(70300)	☐	Filterable Residue	
(80154)	☐	Non-Filterable Residue (110° C) (Susp. Sediment)	
( )	☐	Other Residue	
		TRACE METALS (ug/L)	
		DISSOLVED METALS	
(01000)	☐	Arsenic, Dissolved	
(01020)	☐	Boron, Dissolved	
(01025)	☐	Cadmium, Dissolved	
(01030)	☐	Chromium, Dissolved	
(01040)	☐	Copper, Dissolved	
(01046)	☐	Iron, Dissolved	
(01049)	☐	Lead, Dissolved	
(01056)	☐	Manganese, Dissolved	
(71890)	☐	Mercury, Dissolved	
(01065)	☐	Nickel, Dissolved	
(01074)	☐	Silver, Dissolved	
(01090)	☐	Zinc, Dissolved	
( )	☐	Other	
( )	☐	Other	
		TOTAL METALS	
(01002)	☐	Arsenic, Total	
(01022)	☐	Boron, Total	
(01027)	☐	Cadmium, Total	
(01032)	☐	Chromium, + 6	
(01034)	☐	Chromium, Total	
(01042)	☐	Copper, Total	
(01045)	☐	Iron, Total	
(01051)	☐	Lead, Total	
(01055)	☐	Manganese, Total	
(71900)	☐	Mercury, Total	
(01067)	☐	Nickel, Total	
(01077)	☐	Silver, Total	
(01092)	☐	Zinc, Total	
( )	☐	Other	
( )	☐	Other	

Date Completed 11/2/80 Date Reported 11/2/80
Chemist William [illegible]
Remarks:

HWH-0258

IDAHO DEPARTMENT OF HEALTH AND WELFARE
BUREAU OF WATER QUALITY — BUREAU OF LABORATORIES

172

COLIFORM DENSITY TESTS

STORET No.

NPDES No.

Date of Collection 81 (YR) 1 (MO) 20 (DAY)

Time of Collection 12:10 PM Depth (Ft. or M)

Sampling Point Location [redacted] Dairy
Pt #3 Bulk [illegible]

Date Submitted 81 (YR) 1 (MO) 20 (DAY)

Submitted by Russ Reck

Type of Sample (check appropriate boxes)
☐ Wastewater ☐ Raw ☐ Final ☐ Clorinated ☐ Grab
☐ Composite: Begin ____ End ____
☐ Surface water ☐ Cross Composite

Purpose of Sample
☐ Intensive survey ☐ Trend
☐ Compliance ☐ Other

This is low because of lab error? Russ

Sample taken from (check one)
☐ Spring ☐ Creek ☐ River ☐ Reservoir
☐ Lake ☐ Lagoon ☐ STP ☑ Industrial

Preserved Samples Submitted
☐ cooled, 4°C
☐ Sodium thiosulfate

Est. Count 500

Time Set Up 4:00 PM

Date Set Up 1-20-81

STORET Code (31501)			STORET Code (31616)			STORET Code (31679)			
☑ Total Coliform (MF)			☑ Fecal Coliform (MF)			☐ Fecal Strep (MF)			☐ Fecal Coliform (MPN)
DIL	#MLS	Count	DIL	#MLS	Count	DIL	#MLS	Count	
1:10	100	TNTC	1:10	100	—				Available only by prior request for clorinated wastewater.
	10	TNTC		10	6				
	1	316		1	0				
316,000 /100 ml			600 /100 ml			/100 ml			

Remarks

Copies Of Report To Russ Reck P.O. Box 1626, Twin Falls, ID 83301

Date Completed 1-21-81

Date Reported 1-21-81

Microbiologist William [illegible]

Fill the bottle to the neck, LEAVE AIR SPACE AT THE TOP.

PY DISTRIBUTION
hite - Person Requesting Test
anery - Laboratory
nk - Water Quality Bureau (Storet)
oldenrod - Extra As Needed

Idaho Department of Health and Welfare
BUREAU OF WATER QUALITY - BUREAU OF LABORATORIES

COLIFORM DENSITY TESTS

See Back For Instructions

LAB NAME (Check One)
☐ Boise
☐ Caldwell
☐ Coeur d'Alene
☐ Idaho Falls
☐ Lewiston
☐ Pocatello
☐ Twin Falls

YPE OF SAMPLE (Check Appropriate Boxes)
☑ Wastewater ☐ Raw ☐ Final ☐ Chlorinated ☐ Grab
☐ Composite: Begin ________ End ________
☑ Surface Water ☐ Cross Composite ☐ Depth Integrated

URPOSE OF SURVEY
☐ Intensive Survey ☐ Trend
☐ Compliance ☒ Other Complaint

PRESERVED SAMPLES SUBMITTED
☒ Cooled, 4° C- ☐ Sodium Thiosulfate

AMPLE TAKEN FROM (Check Appropriate Boxes)
☐ Spring ☐ Creek ☐ River ☐ Reservoir ☐ Lake
☐ STP ☐ Industrial ☐ Well ☒ Drain ☐ Lagoon

+ 1 - TOTAL COLIFORM (MF) STORET Code (31501)
2 - FECAL COLIFORM (MF) STORET Code (31616)
3 - FECAL STREP (MF) STORET Code (31679)

Date Submitted (Yr,Mo,Day) 85 06 12
Collected By Shepard

LOCATION	STORET NO.	NPDES NO.	DATE (Yr,Mo,Day)	TIME 24 Hr. Clock	DEPTH Meters Circle	+	Est. Count	DIL	NO. MLS	COUNT	OFFICE USE
00116-						1					
Drain @ ②			850612	1300		②	1X10^5	1.0	10	100000 [redacted]	
Stone & Willis					DM DBM DVM	③	1X10^5		10	900000	
* 00116-						1					
Drain @ ①			850612	1310		②	1X10^5	1.0	100	500000	
Fremont & Willis					DM DBM DVM	③	1X10^5		100	1300000	
* 00116-						1					
						2					
					DM DBM DVM	3					
* 00116-						1					
						2					
					DM DBM DVM	3					
* 00116-						1					
						2					
					DM DBM DVM	3					
* 00116-						1					
						2					
					DM DBM DVM	3					
* 00116-						1					
						2					
					DM DBM DVM	3					
* 00116-						1					
						2					
					DM DBM DVM	3					
* 00116-						1					
						2					
					DM DBM DVM	3					
* 00116-						1					
						2					
					DM DBM DVM	3					
* 00116-						1					
						2					
					DM DBM DVM	3					

COPIES OF RESULTS TO
Name Shepard
Address 801 Reserve
City, State, Zip

Set Up Date 6/12/85
Set Up Time 4:00
Date Completed
Date Reported
Remarks
Microbiologist

*Intensive Survey Section

[illegible] DHW JUN 18 1985

145

ary - Laboratory
k - Water Quality Bureau (Storet)
idenrod - Extra as needed

WATER QUALITY REPORT
CHEMICAL REPORT

See Back For Instructions

☐ Coeur d'Alene
☐ Idaho Falls
☐ Lewiston
☐ Pocatello
☐ Twin Falls

ORET No. ______
DES No. ______
te of Collection (Yr., Mo., Day) 831212
me of Collection 1150 (24 Hr. Clock) Depth (Meters) ______ Circle One DM DBM DVM

TYPE OF SAMPLES (Check appropriate boxes)

Wastewater ☐ Raw ☐ Final ☐ Chlorinated
Grab ☐ Cross Composite ☐ Depth Integrated
Composite: Begin ______ End ______

SAMPLE TAKEN FROM (Check one)

Spring ☐ Creek ☐ River ☐ Reservoir ☐ Well
Lake ☒ Lagoon ☐ STP ☐ Industrial ☐ Drain

PRESERVED SAMPLES SUBMITTED

Cooled, 4° C ☐ HNO3
H_2SO_4 ☐ NaOH ☐ Other ______

Sampling Point Location [redacted] Dairy
Lagoon
Date Submitted (Yr., Mo., Day) 831213
Submitted By D. Varin

PURPOSE OF SAMPLE (Check one)

☐ Intensive Survey ☐ Trend
☐ Compliance ☒ Other ______

ORET		**DEMAND (mg/L)**
0310)	☒	BOD5(Est: ______) 617
0335)	☐	COD Low Level ______
0340)	☒	High Level 1158
0680)	☐	TOC ______
		NUTRIENTS (mg/L)
0610)	☐	T. Ammonia as N ______
0615)	☐	T. Nitrite as N ______
0620)	☐	T. Nitrate as N ______
0630)	☐	T. $NO_2 + NO_3$ as N ______
0625)	☐	T. Kjeldahl Nitrogen as N ______
0665)	☐	T. Phosphorus as P ______
0669)	☐	T. Hydrolyzable Phosphorus as P ______
'0507)	☐	Ortho Phosphate as P ______
		MINERALS (mg/L)
0095)	☐	Sp. Conductance (umhos/cm) ______
0900)	☐	Hardness as $CaCO_3$ ______
0410)	☐	T. Alkalinity as $CaCO_3$ ______
0425)	☐	Bicarbonate Alk. as $CaCO_3$ ______
0430)	☐	Carbonate Alk. as $CaCO_3$ ______
0916)	☐	Calcium ______
0927)	☐	Magnesium ______
0929)	☐	Sodium ______
0937)	☐	Potassium ______
0940)	☐	Chloride ______
0951)	☐	Fluoride ______
0945)	☐	Sulphate as SO_4 ______
0956)	☐	Silica as SiO_2 ______
)	☐	Other Minerals ______
		MISCELLANEOUS
0076)	☐	Turbidity (NTU) ______
0403)	☐	pH (SU) ______
0720)	☐	Total Cyanide (mg/L) ______
0116)	☐	Intensive Survey No. ______

RETURN TEST RESULTS TO

George Varin
801 Reserve ST.
Boise State Id Zip Code

STORET Code		**RESIDUE (mg/L)**
(00500)	☐	Total Residue ______
(00530)	☐	Non-Filterable Residue (105° C) (Suspended Solids) ______
(70300)	☐	Filterable Residue ______
(80154)	☐	Non-Filterable Residue (110° C) (Susp. Sediment) ______
( )	☐	Other Residue ______
		TRACE METALS (ug/L)
		DISSOLVED METALS
(01000)	☐	Arsenic, Dissolved ______
(01020)	☐	Boron, Dissolved ______
(01025)	☐	Cadmium, Dissolved ______
(01030)	☐	Chromium, Dissolved ______
(01040)	☐	Copper, Dissolved ______
(01046)	☐	Iron, Dissolved ______
(01049)	☐	Lead, Dissolved ______
(01056)	☐	Manganese, Dissolved ______
(71890)	☐	Mercury, Dissolved ______
(01065)	☐	Nickel, Dissolved ______
(01075)	☐	Silver, Dissolved ______
(01090)	☐	Zinc, Dissolved ______
( )	☐	Other ______
( )	☐	Other ______
		TOTAL METALS
(01002)	☐	Arsenic, Total ______
(01022)	☐	Boron, Total ______
(01027)	☐	Cadmium, Total ______
(01032)	☐	Chromium, + 6 ______
(01034)	☐	Chromium, Total ______
(01042)	☐	Copper, Total ______
(01045)	☐	Iron, Total ______
(01051)	☐	Lead, Total ______
(01055)	☐	Manganese, Total ______
(71900)	☐	Mercury, Total ______
(01067)	☐	Nickel, Total ______
(01077)	☐	Silver, Total ______
(01092)	☐	Zinc, Total ______
( )	☐	Other ______
( )	☐	Other ______

Date Completed ______ Date Reported 12-27-83
Chemist J. A. [illegible] BHW Dept. Lab DEC 27 1983
Remarks:

RECEIVED
DEC 28 1983
DIVISION OF
ENVIRONMENT

HWH-0258

IDAHO DEPARTMENT OF HEALTH AND WELFARE
BUREAU OF WATER QUALITY — BUREAU OF LABORATORIES
COLIFORM DENSITY TESTS

RECEIVED DEC 16 1983

STORET No.	Sampling Point Location [redacted] Sugar
NPDES No.	
Date of Collection (YR) 83 (MO) 12 (DAY) 12	Date Submitted (YR) 83 (MO) 12 (DAY) 13
Time of Collection 11:50 Depth (Ft. or M)	Submitted by D. Varin

Type of Sample (check appropriate boxes)
☒ Wastewater ☐ Raw ☐ Final ☐ Clorinated ☒ Grab
☐ Composite: Begin ______ End ______
☐ Surface water ☐ Cross Composite

Purpose of Sample
☐ Intensive survey ☐ Trend
☐ Compliance ☒ Other ______

Sample taken from (check one)
☐ Spring ☐ Creek ☐ River ☐ Reservoir
☐ Lake ☒ Lagoon ☐ STP ☐ Industrial

Preserved Samples Submitted
☒ cooled, 4°C
☒ Sodium thiosulfate

Est. Count 10,000
Time Set Up 2:30 pm
Date Set Up 12-13-83

STORET Code (31501)			STORET Code (31616)			STORET Code (31679)			
☐ Total Coliform (MF)			☒ Fecal Coliform (MF)			☐ Fecal Strep (MF)			☐ Fecal Coliform (MPN)
DIL	#MLS	Count	DIL	#MLS	Count	DIL	#MLS	Count	
			1-100	100	TNTC				Available only by prior request for clorinated wastewater.
				10	TNTC				
				1	35				
/100 ml			3500 /100 ml			/100 ml			

Remarks

Copies Of Report To E. Varin, 801 Reserve DOE

Date Completed
Date Reported
Microbiologist
DH Cent. Lab DEC 15 1983

Fill the bottle to the neck, LEAVE AIR SPACE AT THE TOP.

White - Person Requesting Test
Canary - Laboratory
Pink - Water Quality Bureau (Storet)
Goldenrod - Extra as needed

BUREAU OF LABORATORIES

WATER QUALITY REPORT
CHEMICAL REPORT

See Back For Instructions

1.1c. [redacted] DAIRY

☐ Boise
☐ Caldwell
☐ Coeur d'Alene
☐ Idaho Falls
☐ Lewiston
☐ Pocatello
☐ Twin Falls

STORET No. Discharge to Canal
NPDES No.
Date of Collection (Yr., Mo., Day)
Time of Collection (24 Hr. Clock) Depth (Meters) Circle One DM DBM DVM

Sampling Point Location [redacted] DAIRY
Date Submitted (Yr., Mo., Day) 11/20/80
Submitted By Gary Burkett

PURPOSE OF SAMPLE (Check one)

☐ Intensive Survey ☐ Trend
☐ Compliance ☐ Other

TYPE OF SAMPLES (Check appropriate boxes)

☑ Wastewater ☐ Raw ☐ Final ☐ Chlorinated
☐ Grab ☐ Cross Composite ☐ Depth Integrated
☐ Composite: Begin End

SAMPLE TAKEN FROM (Check one)

☐ Spring ☑ Creek ☐ River ☐ Reservoir ☐ Well
☐ Lake ☐ Lagoon ☐ STP ☐ Industrial ☐ Drain

PRESERVED SAMPLES SUBMITTED

☐ Cooled, 4° C ☐ HNO_3
☐ H_2SO_4 ☐ NaOH ☐ Other

STORET Code		DEMAND (mg/L)	
(00310)	☑	BOD_5(Est: 5000)	650
(00335)	☐	COD Low Level	
(00340)	☑	High Level (5000 est)	320
(00680)	☐	TOC	
		NUTRIENTS (mg/L)	
(00610)	☐	T. Ammonia as N	
(00615)	☐	T. Nitrite as N	
(00620)	☐	T. Nitrate as N	
(00630)	☐	T. $NO_2 + NO_3$ as N	
(00625)	☐	T. Kjeldahl Nitrogen as N	
(00665)	☐	T. Phosphorus as P	
(00669)	☐	T. Hydrolyzable Phosphorus as P	
(70507)	☐	Ortho Phosphate as P	
		MINERALS (mg/L)	
(00095)	☐	Sp. Conductance (umhos/cm)	
(00900)	☐	Hardness as $CaCO_3$	
(00410)	☐	T. Alkalinity as $CaCO_3$	
(00425)	☐	Bicarbonate Alk. as $CaCO_3$	
(00430)	☐	Carbonate Alk. as $CaCO_3$	
(00916)	☐	Calcium	
(00927)	☐	Magnesium	
(00929)	☐	Sodium	
(00937)	☐	Potassium	
(00940)	☐	Chloride	
00951)	☐	Fluoride	
00945)	☐	Sulphate as SO_4	
0956)	☐	Silica as SiO_2	
)	☐	Other Minerals	
		MISCELLANEOUS	
0076)	☐	Turbidity (NTU)	
403)	☐	pH (SU)	
720)	☐	Total Cyanide (mg/L)	
116)	☐	Intensive Survey No.	

RETURN TEST RESULTS TO

ary R Burkett DOE
O Box 1626
in Falls State ID Zip Code 83301

STORET Code		RESIDUE (mg/L)	
(00500)	☐	Total Residue	
(00530)	☐	Non-Filterable Residue (105° C) (Suspended Solids)	
(70300)	☐	Filterable Residue	
(80154)	☐	Non-Filterable Residue (110° C) (Susp. Sediment)	
( )	☐	Other Residue	
		TRACE METALS (ug/L)	
		DISSOLVED METALS	
(01000)	☐	Arsenic, Dissolved	
(01020)	☐	Boron, Dissolved	
(01025)	☐	Cadmium, Dissolved	
(01030)	☐	Chromium, Dissolved	
(01040)	☐	Copper, Dissolved	
(01046)	☐	Iron, Dissolved	
(01049)	☐	Lead, Dissolved	
(01056)	☐	Manganese, Dissolved	
(71890)	☐	Mercury, Dissolved	
(01065)	☐	Nickel, Dissolved	
(01074)	☐	Silver, Dissolved	
(01090)	☐	Zinc, Dissolved	
( )	☐	Other	
( )	☐	Other	
		TOTAL METALS	
(01002)	☐	Arsenic, Total	
(01022)	☐	Boron, Total	
(01027)	☐	Cadmium, Total	
(01032)	☐	Chromium, + 6	
(01034)	☐	Chromium, Total	
(01042)	☐	Copper, Total	
(01045)	☐	Iron, Total	
(01051)	☐	Lead, Total	
(01055)	☐	Manganese, Total	
(71900)	☐	Mercury, Total	
(01067)	☐	Nickel, Total	
(01077)	☐	Silver, Total	
(01092)	☐	Zinc, Total	
( )	☑	Other	Coliform (very high)
( )	☐	Other	

Date Completed 11-25-80 Date Reported 11-25-80
Chemist William [illegible]
Remarks:

STRIBUTION
- Person Requesting Test
nary - Laboratory
Pink - Water Quality Bureau (Storet)
Goldenrod - Extra as needed

Department of Health & Welfare
BUREAU OF WATER QUALITY
BUREAU OF LABORATORIES

WATER QUALITY REPORT
CHEMICAL REPORT

See Back For Instructions

LAB NAME (Check One)
☐ Boise
☐ Caldwell
☐ Lewiston
☐ Pocatello
☐ Twin Falls

RECEIVED 1982

STORET No. ______
NPDES No. ______
Date of Collection (Yr., Mo., Day) 82 5 27
Time of Collection 1100 (24 Hr. Clock) Depth (Meters) ______
Circle One DM DGM DVM

Sampling Point Location [redacted]
Fregan Drain [illegible]
Date Submitted (Yr., Mo., Day) [illegible]
Submitted By ______

PURPOSE OF SAMPLE (Check one)
☐ Intensive Survey ☐ Trend
☒ Compliance ☐ Other ______

TYPE OF SAMPLES (Check appropriate boxes)
☒ Wastewater ☐ Raw ☐ Final ☐ Chlorinated
☑ Grab ☐ Cross Composite ☐ Depth Integrated
☐ Composite: Begin ______ End ______

SAMPLE TAKEN FROM (Check one)
☐ Spring ☐ Creek ☐ River ☐ Reservoir ☐ Well
☐ Lake ☐ Lagoon ☐ STP ☐ Industrial ☒ Drain

PRESERVED SAMPLES SUBMITTED
☒ Cooled, 4° C ☐ HNO_3
☐ H_2SO_4 ☐ NaOH ☐ Other ______

STORET Code		DEMAND (mg/L)	
(00310)	☒	BOD_5(Est: 700)	279
(00335)	☐	COD Low Level	
(00340)	☐	High Level	
(00680)	☐	TOC	
		NUTRIENTS (mg/L)	
(00610)	☐	T. Ammonia as N	
(00615)	☐	T. Nitrite as N	
(00620)	☐	T. Nitrate as N	
(00630)	☐	T. $NO_2 + NO_3$ as N	
(00625)	☐	T. Kjeldahl Nitrogen as N	
(00665)	☐	T. Phosphorus as P	
(00669)	☐	T. Hydrolyzable Phosphorus as P	
(70507)	☐	Ortho Phosphate as P	
		MINERALS (mg/L)	
(00095)	☐	Sp. Conductance (umhos/cm)	
(00900)	☐	Hardness as $CaCO_3$	
(00410)	☐	T. Alkalinity as $CaCO_3$	
(00425)	☐	Bicarbonate Alk. as $CaCO_3$	
(00430)	☐	Carbonate Alk. as $CaCO_3$	
(00916)	☐	Calcium	
(00927)	☐	Magnesium	
(00929)	☐	Sodium	
(00937)	☐	Potassium	
(00940)	☐	Chloride	
(00951)	☐	Fluoride	
(00945)	☐	Sulphate as SO_4	
(00956)	☐	Silica as SiO_2	
( )	☐	Other Minerals	
		MISCELLANEOUS	
(00076)	☒	Turbidity (NTU)	508
(00403)	☐	pH (SU)	
(00720)	☐	Total Cyanide (mg/L)	
(00116)	☐	Intensive Survey No.	

RETURN TEST RESULTS TO
Name
Address 801 Re[illegible]
City State Zip Code

STORET Code		RESIDUE (mg/L)	
(00500)	☐	Total Residue	
(00530)	☒	Non-Filterable Residue (105° C) (Suspended Solids)	2600
(70300)	☐	Filterable Residue	
(80154)	☐	Non-Filterable Residue (110° C) (Susp. Sediment)	
( )	☐	Other Residue	
		TRACE METALS (ug/L)	
		DISSOLVED METALS	
(01000)	☐	Arsenic, Dissolved	
(01020)	☐	Boron, Dissolved	
(01025)	☐	Cadmium, Dissolved	
(01030)	☐	Chromium, Dissolved	
(01040)	☐	Copper, Dissolved	
(01046)	☐	Iron, Dissolved	
(01049)	☐	Lead, Dissolved	
(01056)	☐	Manganese, Dissolved	
(71890)	☐	Mercury, Dissolved	
(01065)	☐	Nickel, Dissolved	
(01075)	☐	Silver, Dissolved	
(01090)	☐	Zinc, Dissolved	
( )	☐	Other	
( )	☐	Other	
		TOTAL METALS	
(01002)	☐	Arsenic, Total	
(01022)	☐	Boron, Total	
(01027)	☐	Cadmium, Total	
(01032)	☐	Chromium, + 6	
(01034)	☐	Chromium, Total	
(01042)	☐	Copper, Total	
(01045)	☐	Iron, Total	
(01051)	☐	Lead, Total	
(01055)	☐	Manganese, Total	
(71900)	☐	Mercury, Total	
(01067)	☐	Nickel, Total	
(01077)	☐	Silver, Total	
(01092)	☐	Zinc, Total	
( )	☐	Other	
( )	☐	Other	

Date Completed ______ Date Reported 6-2-82
Chemist ______
Remarks: J. A. Rolle JUN - 3 1982

▿ DISTRIBUTION
White - Person Requesting Test
Canary - Laboratory
Pink - Water Quality Bureau (Storet)
Goldenrod - Extra as needed

Department of Health & Welfare
BUREAU OF WATER QUALITY
BUREAU OF LABORATORIES

WATER QUALITY REPORT
CHEMICAL REPORT

See Back For Instructions

LAB NAME (Check One)
☐ Boise
☐ Caldwell
☐ Coeur d'Alene
☐ Idaho Falls
☐ Lewiston
☒ Pocatello
☐ Twin Falls

1982

STORET No. ________
NPDES No. ________
Date of Collection (Yr., Mo., Day) 82 5 27
Time of Collection 1100 (24 Hr. Clock) Depth (Meters) ____ Circle One DM DBM DVM

Sampling Point Location [illegible] discharge (018)
Date Submitted (Yr., Mo., Day) 5 27
Submitted By [illegible]

PURPOSE OF SAMPLE (Check one)
☐ Intensive Survey ☐ Trend
☒ Compliance ☐ Other ________

TYPE OF SAMPLES (Check appropriate boxes)
☒ Wastewater ☐ Raw ☐ Final ☐ Chlorinated
☐ Grab ☐ Cross Composite ☐ Depth Integrated
☐ Composite: Begin ____ End ____

SAMPLE TAKEN FROM (Check one)
☐ Spring ☐ Creek ☐ River ☐ Reservoir ☐ Well
☐ Lake ☐ Lagoon ☐ STP ☐ Industrial ☒ Drain

PRESERVED SAMPLES SUBMITTED
☒ Cooled, 4° C ☐ HNO_3
☐ H_2SO_4 ☐ NaOH ☐ Other ____

STORET Code		DEMAND (mg/L)	
(00310)	☒	BOD_5 (Est: 500)	173
(00335)	☐	COD Low Level	
(00340)	☐	High Level	
(00680)	☐	TOC	
		NUTRIENTS (mg/L)	
(00610)	☐	T. Ammonia as N	
(00615)	☐	T. Nitrite as N	
(00620)	☐	T. Nitrate as N	
(00630)	☐	T. $NO_2 + NO_3$ as N	
(00625)	☐	T. Kjeldahl Nitrogen as N	
(00665)	☐	T. Phosphorus as P	
(00669)	☐	T. Hydrolyzable Phosphorus as P	
(70507)	☐	Ortho Phosphate as P	
		MINERALS (mg/L)	
(00095)	☐	Sp. Conductance (umhos/cm)	
(00900)	☐	Hardness as $CaCO_3$	
(00410)	☐	T. Alkalinity as $CaCO_3$	
(00425)	☐	Bicarbonate Alk. as $CaCO_3$	
(00430)	☐	Carbonate Alk. as $CaCO_3$	
(00916)	☐	Calcium	
(00927)	☐	Magnesium	
(00929)	☐	Sodium	
(00937)	☐	Potassium	
(00940)	☐	Chloride	
(00951)	☐	Fluoride	
(00945)	☐	Sulphate as SO_4	
(00955)	☐	Silica as SiO_2	
( )	☐	Other Minerals	
		MISCELLANEOUS	
(00076)	☒	Turbidity (NTU)	320
(00403)	☐	pH (SU)	
(00720)	☐	Total Cyanide (mg/L)	
(00116)	☐	Intensive Survey No.	

RETURN TEST RESULTS TO
Name [illegible]
Address 801 [illegible]
City [illegible] State [illegible] Zip Code [illegible]

STORET Code		RESIDUE (mg/L)	
(00500)	☐	Total Residue	
(00530)	☒	Non-Filterable Residue (105° C) (Suspended Solids)	110
(70300)	☐	Filterable Residue	
(80154)	☐	Non-Filterable Residue (110° C) (Susp. Sediment)	
( )	☐	Other Residue	
		TRACE METALS (ug/L)	
		DISSOLVED METALS	
(01000)	☐	Arsenic, Dissolved	
(01020)	☐	Boron, Dissolved	
(01025)	☐	Cadmium, Dissolved	
(01030)	☐	Chromium, Dissolved	
(01040)	☐	Copper, Dissolved	
(01046)	☐	Iron, Dissolved	
(01049)	☐	Lead, Dissolved	
(01056)	☐	Manganese, Dissolved	
(71890)	☐	Mercury, Dissolved	
(01065)	☐	Nickel, Dissolved	
(01075)	☐	Silver, Dissolved	
(01090)	☐	Zinc, Dissolved	
( )	☐	Other	
( )	☐	Other	
		TOTAL METALS	
(01002)	☐	Arsenic, Total	
(01022)	☐	Boron, Total	
(01027)	☐	Cadmium, Total	
(01032)	☐	Chromium, + 6	
(01034)	☐	Chromium, Total	
(01042)	☐	Copper, Total	
(01045)	☐	Iron, Total	
(01051)	☐	Lead, Total	
(01055)	☐	Manganese, Total	
(71900)	☐	Mercury, Total	
(01067)	☐	Nickel, Total	
(01077)	☐	Silver, Total	
(01092)	☐	Zinc, Total	
( )	☐	Other	
( )	☐	Other	

Date Completed ____ Date Reported 6-2-82
Chemist ____
Remarks: J. A. Dodds JUN - 3 1982

Canary - Laboratory
Pink - Water Quality Bureau (Storet)
Goldenrod - Extra as needed

WATER QUALITY REPORT
CHEMICAL REPORT
See Back For Instructions

☐ Caldwell
☐ Coeur d'Alene
☐ Idaho Falls
☐ Lewiston
☐ Pocatello
☐ Twin Falls

STORET No. ______
NPDES No. ______
Date of Collection (Yr., Mo., Day) ______
Time of Collection ______ (24 Hr. Clock) Depth (Meters) ______ Circle One DM DBM DVM

Sampling Point Location [redacted] Dairy
Pit #3 Back [illegible] discharge to drai
Date Submitted (Yr., Mo., Day) 1/20/81
Submitted By Russ Renk

PURPOSE OF SAMPLE (Check one)
☐ Intensive Survey ☐ Trend
☐ Compliance ☑ Other ______

TYPE OF SAMPLES (Check appropriate boxes)
☐ Wastewater ☐ Raw ☐ Final ☐ Chlorinated
☐ Grab ☐ Cross Composite ☐ Depth Integrated
☐ Composite: Begin ______ End ______

SAMPLE TAKEN FROM (Check one)
☐ Spring ☐ Creek ☐ River ☐ Reservoir ☐ Well
☐ Lake ☐ Lagoon ☐ STP ☐ Industrial ☐ Drain

PRESERVED SAMPLES SUBMITTED
☐ Cooled, 4° C ☐ HNO_3
☐ H_2SO_4 ☐ NaOH ☐ Other ______

STORET Code		DEMAND (mg/L)	
(00310)	☐	BOD$_5$(Est: ____)	
(00335)	☑	COD Low Level	4100
(00340)	☐	300 [illegible] High Level	
(00680)	☐	TOC	
		NUTRIENTS (mg/L)	
(00610)	☐	T. Ammonia as N	
(00615)	☐	T. Nitrite as N	
(00620)	☐	T. Nitrate as N	
(00630)	☐	T. $NO_2 + NO_3$ as N	
(00625)	☐	T. Kjeldahl Nitrogen as N	
(00665)	☐	T. Phosphorus as P	
(00669)	☐	T. Hydrolyzable Phosphorus as P	
(70507)	☐	Ortho Phosphate as P	
		MINERALS (mg/L)	
(00095)	☐	Sp. Conductance (umhos/cm)	
(00900)	☐	Hardness as $CaCO_3$	
(00410)	☐	T. Alkalinity as $CaCO_3$	
(00425)	☐	Bicarbonate Alk. as $CaCO_3$	
(00430)	☐	Carbonate Alk. as $CaCO_3$	
(00916)	☐	Calcium	
(00927)	☐	Magnesium	
(00929)	☐	Sodium	
(00937)	☐	Potassium	
(00940)	☐	Chloride	
(00951)	☐	Fluoride	
(00945)	☐	Sulphate as SO_4	
(00956)	☐	Silica as SiO_2	
( )	☐	Other Minerals	
		MISCELLANEOUS	
(00076)	☐	Turbidity (NTU)	
(00403)	☐	pH (SU)	
(00720)	☐	Total Cyanide (mg/L)	
(00116)	☐	Intensive Survey No.	

RETURN TEST RESULTS TO
Name Russ RENK
Address P.O. Box 1626
City Twin Falls State ID Zip Code 83301

STORET Code		RESIDUE (mg/L)	
(00500)	☐	Total Residue	
(00530)	☐	Non-Filterable Residue (105° C) (Suspended Solids)	
(70300)	☐	Filterable Residue	
(80154)	☐	Non-Filterable Residue (110° C) (Susp. Sediment)	
( )	☐	Other Residue	
		TRACE METALS (ug/L)	
		DISSOLVED METALS	
(01000)	☐	Arsenic, Dissolved	
(01020)	☐	Boron, Dissolved	
(01025)	☐	Cadmium, Dissolved	
(01030)	☐	Chromium, Dissolved	
(01040)	☐	Copper, Dissolved	
(01046)	☐	Iron, Dissolved	
(01049)	☐	Lead, Dissolved	
(01056)	☐	Manganese, Dissolved	
(71890)	☐	Mercury, Dissolved	
(01065)	☐	Nickel, Dissolved	
(01074)	☐	Silver, Dissolved	
(01090)	☐	Zinc, Dissolved	
( )	☐	Other	
( )	☐	Other	
		TOTAL METALS	
(01002)	☐	Arsenic, Total	
(01022)	☐	Boron, Total	
(01027)	☐	Cadmium, Total	
(01032)	☐	Chromium, + 6	
(01034)	☐	Chromium, Total	
(01042)	☐	Copper, Total	
(01045)	☐	Iron, Total	
(01051)	☐	Lead, Total	
(01055)	☐	Manganese, Total	
(71900)	☐	Mercury, Total	
(01067)	☐	Nickel, Total	
(01077)	☐	Silver, Total	
(01092)	☐	Zinc, Total	
( )	☐	Other	
( )	☐	Other	

Date Completed 1/22/81 Date Reported 1/22/81
Chemist William [illegible]
Remarks:

White - Person Requesting Test
Canary - Laboratory
Pink - Water Quality Bureau (Storet)
Goldenrod - Extra as needed

BUREAU OF LABORATORIES to Drag

WATER QUALITY REPORT
CHEMICAL REPORT

See Back For Instructions

RECEIVED
ENVIRONMENTAL [redacted]

☐ Caldwell
☐ Coeur d'Alene
☐ Idaho Falls
☐ Lewiston
☐ Pocatello
☐ Twin

STORET No. ______
NPDES No. ______
Date of Collection (Yr., Mo., Day) 84 0217
Time of Collection ______ (24 Hr. Clock) Depth (Meters) ______ Circle One DM DBM DVM

Sampling Point Location Ditch from
Drainage Taken by Bill McDonald
Date Submitted (Yr., Mo., Day) ~~Apr~~ 84 03 20
Submitted By D. Varin

PURPOSE OF SAMPLE (Check one)
☐ Intensive Survey ☐ Trend
☐ Compliance ☒ Other ______

TYPE OF SAMPLES (Check appropriate boxes)
☐ Wastewater ☒ Raw ☐ Final ☐ Chlorinated
☒ Grab ☐ Cross Composite ☐ Depth Integrated
☐ Composite: Begin ______ End ______

SAMPLE TAKEN FROM (Check one)
☐ Spring ☐ Creek ☐ River ☐ Reservoir ☐ Well
☐ Lake ☐ Lagoon ☐ STP ☐ Industrial ☒ Drain

PRESERVED SAMPLES SUBMITTED
☒ Cooled, 4° C ☐ HNO_3
☐ H_2SO_4 ☐ NaOH ☐ Other ______

STORET Code		DEMAND (mg/L)	
(00310)	☐	BOD_5(Est: ____)	
(00335)	☐	COD Low Level	
(00340)	☒	High Level	250
(00680)	☐	TOC	
		NUTRIENTS (mg/L)	
(00610)	☐	T. Ammonia as N	
(00615)	☐	T. Nitrite as N	
(00620)	☐	T. Nitrate as N	
(00630)	☐	T. $NO_2 + NO_3$ as N	
(00625)	☐	T. Kjeldahl Nitrogen as N	
(00665)	☐	T. Phosphorus as P	
(00669)	☐	T. Hydrolyzable Phosphorus as P	
(70507)	☐	Ortho Phosphate as P	
		MINERALS (mg/L)	
(00095)	☐	Sp. Conductance (umhos/cm)	
(00900)	☐	Hardness as $CaCO_3$	
(00410)	☐	T. Alkalinity as $CaCO_3$	
(00425)	☐	Bicarbonate Alk. as $CaCO_3$	
(00430)	☐	Carbonate Alk. as $CaCO_3$	
(00916)	☐	Calcium	
(00927)	☐	Magnesium	
(00929)	☐	Sodium	
(00937)	☐	Potassium	
(00940)	☐	Chloride	
(00951)	☐	Fluoride	
(00945)	☐	Sulphate as SO_4	
(00956)	☐	Silica as SiO_2	
( )	☐	Other Minerals	
		MISCELLANEOUS	
(00076)	☐	Turbidity (NTU)	
(00403)	☐	pH (SU)	
(00720)	☐	Total Cyanide (mg/L)	
(00116)	☐	Intensive Survey No.	

STORET Code		RESIDUE (mg/L)	
(00500)	☐	Total Residue	
(00530)	☐	Non-Filterable Residue (105° C) (Suspended Solids)	
(70300)	☐	Filterable Residue	
(80154)	☐	Non-Filterable Residue (110° C) (Susp. Sediment)	
( )	☐	Other Residue	
		TRACE METALS (ug/L)	
DISSOLVED METALS			
(01000)	☐	Arsenic, Dissolved	
(01020)	☐	Boron, Dissolved	
(01025)	☐	Cadmium, Dissolved	
(01030)	☐	Chromium, Dissolved	
(01040)	☐	Copper, Dissolved	
(01046)	☐	Iron, Dissolved	
(01049)	☐	Lead, Dissolved	
(01056)	☐	Manganese, Dissolved	
(71890)	☐	Mercury, Dissolved	
(01065)	☐	Nickel, Dissolved	
(01075)	☐	Silver, Dissolved	
(01090)	☐	Zinc, Dissolved	
( )	☐	Other	
( )	☐	Other	
TOTAL METALS			
(01002)	☐	Arsenic, Total	
(01022)	☐	Boron, Total	
(01027)	☐	Cadmium, Total	
(01032)	☐	Chromium, + 6	
(01034)	☐	Chromium, Total	
(01042)	☐	Copper, Total	
(01045)	☐	Iron, Total	
(01051)	☐	Lead, Total	
(01055)	☐	Manganese, Total	
(71900)	☐	Mercury, Total	
(01067)	☐	Nickel, Total	
(01077)	☐	Silver, Total	
(01092)	☐	Zinc, Total	
( )	☐	Other	
( )	☐	Other	

Date Completed ______ Date Reported 4-2-84
Chemist BWW Boise Lab. APR 0 4 1986
Remarks

RETURN TEST RESULTS TO
Name G. Varin DOE
Address 801 Reserve
City Boise State Id Zip Code 83712